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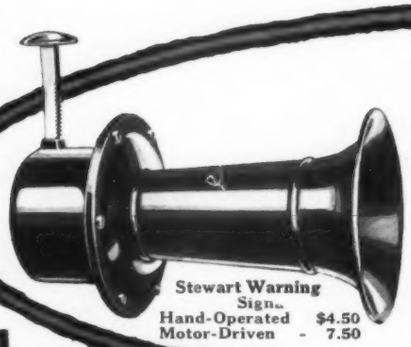

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, APRIL 24, 1919—CHICAGO NO. 17

American Report on British Labor Conditions

Findings of the Employers' Industrial Commission of the U. S. Department of Labor

British Government officials and most employers now believe that the best way to arrive at and to maintain agreements with labor lies in strengthening well established systems or organizations of both employers and employees.

There is a marked disposition among workmen to be represented in the national councils by actual workers. They feel that labor union officials have become detached from the atmosphere of the shop and are not in sympathy.

WASHINGTON, D. C., April 21.—The cause of labor unrest in Great Britain today is the demand of the working people for a better industrial day providing not only better wages, but also better conditions of life and labor. This is a brief statement of the basic cause of conditions which are aggravated by the strain of four years of war, the feeling that labor does not receive its proper share of the combined product of capital and labor and the fact that, under the British labor union system, the process of handling grievances is too slow to get adequate and prompt relief.

These conclusions are taken from the report of the Employers' Industrial Commission, appointed by the U. S. Department of Labor to study the labor situation in Great Britain which has just been filed.

The committee found no panacea for industrial unrest. Many of the workmen were found to be critical of and disposed to disregard their unions, believing that the officials of the unions have become detached from the atmosphere of the shops and have thus lost their proper sympathy for the workmen. They also believe that they are not benefiting properly from inventions and improved shop methods.

Inquiries among a large number of workers in many different lines for suggestions for the improvement of conditions resulted principally in demands for employment insurance, health insurance and old age insurance.

It was found by the committee and pointed out in its report that the term labor, which is employed somewhat differently in England, whether used by working men or employers, always carries a recognition of mental as well as of physical labor. Capital is used to define the stockholder who is usually an absentee proprietor, while the term "worker" included every one contributing to the actual management of the business from the managing director to the men who sweep the floors.

Shorter hours of labor form an important factor, and the 44-hr. and 47-hr. weeks, and even 40-hr. weeks, are being demanded.

That housing is playing an important part in the matter of labor unrest was evidenced by the discovery that less than 200,000 workers out of 14,000,000 own their own homes. At the same time

it was found that many workers do not desire homes in England, in contrast to the ambitions of American workmen.

It was found that shop committees, although sometimes difficult to deal with, result in good by bringing about direct contact of employers with employees. The problem appears to be not only that of securing and keeping good shop committees, but also maintaining them under control of large labor organizations. It was because of this problem that the Whitely plan providing the industrial district councils and works committees was formulated.

Beneath the general turmoil and numerous reports of chaos, the commission found no signs of disorder in England and discovered that in general the government, the employers and the conservative employees are agreed; that co-operation between labor and capital is desirable; that conciliation will benefit both the employers and employees in stabilizing business and in preserving regularly organized unions, and that collective bargaining benefits both employers and employees.

Disregarding the radical groups, who, it is thought, are being fostered by foreign Bolshevists, the commission found that the employers are recognizing organization of employees, that both now recognize the need of maintaining production and have discarded the ideas about restricted outputs, and are very much in favor of the Whitely industrial plan. This plan proposes the establishment of industrial councils comprising employers and employees to deal with industrial problems affecting the entire country, district councils to deal with matters of local concern and works committees made up of workers and the management in each plant to deal with the problems affecting each particular shop.

The commission learned from authorities in England that the radical leaders are opposed to collective bargaining and aim to bring about complete revolution of the present system of society.

Women in industry should not receive the same wages as men, according to the general belief of the British working men, unless they deliver equal value as the men. They point to the fact that unless women produce equal value they will be crowded out of employment if they insist on equal wages.

Following is the complete report of the Industrial Commission, which was composed of E. D. Gundlach, chairman; R. J. Caldwell, Dorre E. Felt, William H. Ingersoll, R. R. Otis and Elden B. Keith, who died while abroad:

Report of the Employers' Industrial Commission

To Hon. ROGER W. BABSON, Director General Information and Education Service, United States Department of Labor, Washington, D. C.:

The commission of employers designated to visit Europe and to report on industrial conditions in order that employers and employees might have the benefit of the longer experience of European—and especially British—employers and labor leaders, submits the following as a statement of its observations in Great Britain:

A Revelation for American Business Men.—What we have learned as to the attitude of the Government toward organizations of labor and organizations of manufacturers and as to the attitude of employers toward the trade unions, and that of labor toward federations of employers, as well as the general system being evolved to handle industrial disputes, proved in more than one respect a revelation to us. We believe it will be a revelation also to those at home, disclosing the promise, we think, of constructive co-operative relations which must result in good for all.

Underneath the seething unrest, as expressed in speeches and in newspapers, we found a remarkable harmony of purpose between Government officials, conservative employees, and practically all employers. These groups are to-day nearly a unit in urging:

First—The spirit of co-operation by recognizing and encouraging organizations of employers and employees; and

Second—The need of maintaining production, former ideas of restrictions on output having been discarded.[1]

The leaders of British industry (the men who control a large share of the world's steel and cotton and other products) and the officials of the great associations of British employers expressed their common verdict as summarized below.

If our observations and findings cause any surprise, our answer can only be that if other American business men will themselves go to Great Britain they will confirm our statements as to the viewpoint of Britain's conservative employers.

Sources of Information

Arriving in London Feb. 4 we presented our credentials to the United States Ambassador. He apprised the British home office, from which we received carte blanche to gather information from any source that seemed to us desirable.

Our next official step was to present ourselves before Sir Robert S. Horne, Minister of Labor, and Sir David J. Shackleton, K. C. B., permanent secretary of the Ministry of Labor.

Both of these gentlemen expressed themselves without reserve. They reviewed the situation in a thoroughly comprehensive manner. This was particularly enlightening, because of the fact that the Ministry of Labor, since its foundation in December, 1916, has successfully devoted a large part of its efforts to adjusting labor disputes and their avoidance.

Shortly thereafter we were privileged to have an audience lasting several hours with George H. Roberts, at present Food Commissioner and former Minister of Labor prior to Sir Robert S. Horne's appointment a few months ago.

In the meantime, and up to the present, it has been our good fortune to have a continuous series of conferences throughout the day and each evening with members of both Houses of Parliament, the Federation of British Industries, the chairman of the Engineering and National Employers' Federations, and prominent students of industrial problems.

Also on a trip to industrial centers of the north, viz., Birmingham, Sheffield, Manchester and Glasgow, your commission interviewed numerous large employers and officials of labor organizations, groups of workingmen of all degrees of radical and conservative thought. Like the Government officials in London, these employers, the workmen and labor leaders, freely expressed to us their ideas respecting the industrial situation in Great Britain.

We also had the advantage of a conference with the admiral commander in chief of the Rosyth Government Dockyard; also with the chiefs of the municipal tramways, gas works and electric undertakings of the city of Manchester, at a meeting presided over by the lord mayor of that municipality; also with the chiefs of similar municipal services at Glasgow, presided over by the lord provost.

Our search for sources of reliable information and our contact with men rep-

[1] *All this is predicated on the accepted belief that labor is entitled to more consideration than it has heretofore been accorded.*—THE CHAIRMAN.

resenting all elements in society, stations in the community, and viewpoints, has been greatly facilitated by the capable efforts of the staff of experts and secretaries who accompanied us.

Summary of the Situation

Here is our summary of the British industrial situation:

In 1914 the leaders of the national labor unions signed an agreement with the Government pledging their organizations not to strike during the war.

But the Government soon found that the existing organizations could not control the workers. Because the hands of the national unions were tied, a succession of unauthorized strikes broke out locally in growing numbers.

Unrest in Individual Shops.—The men in the shops, sometimes through newly elected committees—more often through their regular shop stewards (the name previously given to the representatives of the unions working in the shops)—made successive demands upon their individual employers, either by strike or threat of strike. When an employer gave in to such demands this fomented other demands elsewhere by workers who wanted what others had secured, or more. Against these so-called "unconstitutional" strikes ("unconstitutional" because not authorized by the regularly constituted unions) the national leaders of labor unions seemed well nigh powerless.

The month of the armistice saw the expansion, perhaps more than a beginning, of new forms of organizations of shop stewards among themselves. These men to a large degree, while union men themselves, to-day ignore or defy the orders of the union leaders. By securing concessions from individual employers without regard to the central unions, the shop stewards feel that they have proven their power (temporarily, at least) to the workingmen in the shops.

Radicals Among the Shop Stewards.—Among the shop stewards are the young men of radical temperament and with extremely brief and limited experience in responsibility. They are the ones who are propounding the theories about a new state of society, and among them are the radicals who would eliminate the profit system.[1]

Many of these radical leaders frankly state that they oppose all machinery to bring employers and employees together by collective bargaining, because bargaining and conciliation tend to continue the present system of society.

Opposed to the radical wing of the shop steward movement we find:

First—Employers who are practically a unit in their general attitude;

Second — Regular organizations of labor unions with their leaders; and

Third—Those shop committees that believe in getting together with the employer, not in order to crowd demands until all profits are absorbed by labor, but sincerely and genuinely in order to adjust differences by collective bargaining.

The employers and conservative labor leaders in Great Britain have as their background a prolonged experience in

[1] *It is also to be recognized that among the shop stewards are capable leaders who believe that the demands of the national labor leaders are too modest.*—WILLIAM H. INGERSOLL.

THE COMMISSION'S FINDINGS

1. *EMPLOYERS IN GREAT BRITAIN generally recognize the desirability of bargaining collectively with labor.*

2. *EMPLOYERS nearly all agree that collective bargaining should always be undertaken between associations of employers and the regularly established well-organized trade-unions.*

> *While many manufacturers welcome organizations of workmen in their factories (shop or works committees), they want to limit the activities of such bodies to purely local grievances, and decidedly desire that the committee members come under the discipline of their unions.*

3. *MOST EMPLOYERS freely recognize the right of labor to organize; they regard organization as greatly contributing to the stability of industry. Some large manufacturers declare that they wish to see every workman within the unions, so that they must all come under organization control. Others feel that 100 per cent organization might lead to dangerous types of universal strikes and lockouts. The more conservative employers appear to make no effort to help along organizations of labor, merely dealing with such organizations when they appear on the scene.*

4. *EMPLOYEES IN GREAT BRITAIN are divided in sentiment shading from those who want to maintain the trade-unions along the regularly established so-called "constitutional" lines to ultra-radical socialists.*

5. *EMPLOYEES are nearly a unit, however, in expressing opposition to the use of force. The most radical who desire "now" a complete overturning of the present social structure, usually admit on close questioning that "now" may mean many years. They want to "start" now. Practically none appear to approve of a sudden change as in Russia.*

6. *EMPLOYEES of the ultraradical type look askance at collective bargaining and organizations of labor and capital. They freely express the view that they do not wish harmony between employees and employers, since harmony would help to continue the present system of society.*

7. *EMPLOYEES of the more conservative type (and to your commissioners they appear to represent the vast majority of British workmen) are largely in accord with employers in the desire (1) to head off labor unrest at this period; (2) to strengthen the unions by holding members under control; (3) to increase production for the sake of the nation, workmen included—with no restriction on output except as it affects the health of the worker; (4) to leave control of business policies in the hands of those managing the business.*

8. *GOVERNMENT OFFICIALS appear to be uniformly of the opinion that the Government should function in labor unrest only as an absolutely last unavoidable resort. On the other hand, they maintain the right of the Government to step in when necessary in order to protect public interests against minorities which try to force their terms upon the people.*

9. *IN GENERAL the Government, and most employers and conservative employees appear to be agreed:*

That the spirit of co-operation between labor and capital is highly desirable.

That the spirit of conciliation is important for the benefit of the employer in stabilizing his business and for the benefit of the employee in preserving his regularly organized unions.

That in collective bargaining the right-minded employer will not attempt to return to the pre-war industrial era, and that the right-minded employee will not attempt to crowd his demands to the point at which the stimulus for private business enterprise would disappear.

The spirit of a genuinely better NEW (and not NOVEL) era is thus being fostered by widely varied elements of Great Britain's industrial system.—R. J. Caldwell, Dorr E. Felt, Wm. H. Ingersoll, Robt. R. Otis, and E. T. Gundlach, Chairman.

The more intelligent workers realize that merely advancing wages does not meet requirements if the purchasing power of money is thereby proportionately reduced.

In their demand for a better industrial day, the working people seek not merely small non-essentials, nor commonplace essentials, but a real step forward in their conditions of life and labor.

dealing with each other by organization, and a great majority of them believe that it is best for both employers and employed to treat with each other collectively.

Employers Prefer to See Labor Well Organized—Years before the outbreak of the war the thought of breaking up labor organizations had been practically given up by employers, and the union leaders had abandoned opposition to associations of employers.

As the war measures took away the power of the central organizations over the workmen, the situation which developed seems to have convinced most employers as never before that workingmen are best dealt with by negotiation through large bodies of labor; not necessarily in order to concede to their demands but merely for the purpose of dealing with labor en masse.

For the war showed that irrespective of laws, employers' opposition, or Governmental agreements, workingmen today will find some way or other to act together in groups when their interests are vitally affected.

So the Government officials and most employers now express the belief that the best way to arrive at and to maintain agreements with labor lies in strengthening well-established systems or organizations of both employers and employees. These, they say, can be held responsible and kept to concerted action better than incoherent small groups.

Another point: The shop committees, although often difficult to deal with, proved to many employers that much good resulted from direct contact with their men.

By means of these committees industry avoided the necessity of depending on the detailed and intricate machinery of trade unionism for the adjustment of purely local grievances.

The problem then remained as to how to get and keep shop committees and yet maintain them under the control of the larger labor organizations. An effort in the direction of fitting shop and works committees into larger and more responsible organizations of labor was made by a Government plan, which in the last six or eight months has formed the basis of a great deal of public discussion in Great Britain. We refer to the program set forth in the British documents known as the Whitley reports.

Whitley Plan Explained

Before we came to England our attention was directed to the Whitley reports.[1] They were drafted by a sub-committee of the Committee on Reconstruction appointed by the Prime Minister in 1916.

Briefly the Whitley plan proposes the establishment for each industry of:

1. Joint standing industrial councils made up of representatives of employers and employees to deal with the larger questions that affect the industry throughout the whole country;
2. District councils constituted in like manner to deal with matters of local concern; and
3. Works committees also composed of representatives of the workers in each plant and the management to deal with conditions affecting each shop but not touching the larger aspects handled by the district councils or the national joint standing industrial council. Such matters as shop sanitation, the hours of beginning and ending work, luncheon time and rest periods, are to be dealt with by the works committee.

The Whitley plan is exceedingly elastic. It is not the intention of the British Government to force any cut-and-dried formula upon the industries of the country, but national joint standing industrial councils and district councils are essential to a fully developed Whitley scheme.

Councils in 30 Industries.—National joint industrial councils have been formed in 30 different industries, but the fully developed scheme, including district councils and works committees, has been established in only three industries, viz.: Matches, pottery and rubber.

In several other industries works committees have been set up in many establishments in accordance with the recommendations of the Whitley committee. Eventually, these works committees are to be organized by districts and nationally into a true Whitley scheme, but at present they are nothing more than the beginning of such a scheme.

In fact, we soon discovered that the details of the system, which was elaborated in five successive reports by the Whitley committee, as far as being put into operation is concerned now stands in the embryonic stage, and the new machinery has not yet been developed far enough to afford sufficient experience on which to base definite conclusions.

The Whitley plan is viewed with much favor by officials of the Ministry of Labor, which is endeavoring to effect the organization of various lines of industry under this plan.

Various municipally operated public service departments are also proposing to organize under systems based on the general idea of the Whitley plan.

Employers Favor Whitley Plan.—Inquiry developed that the employers, when conversant with the Whitley plan, almost universally favor it; also that employers favor complete union organization of the employed in established labor unions and favor not only collective bargaining, but closer touch with the employed. About the only note of doubt respecting the benefits of the Whitley system, on the part of the employers, relates to the question of the possibility that it might later on lead to undesirable results.

In short, the advocates of the Whitley plan expressed the belief that it would result in complete unionization of all the workers in those industries adopting it; also that it would prevent many strikes. The idea is that small grievances would be adjusted around a council table rather than being allowed to continue as foci of discontent until they grow into grave matters.

Objections of Some Employees.—On the other hand, while some of the higher labor union officials favor the Whitley plan, a large portion of the more radical among the minor labor union officials and the workmen do not indorse it enthusiastically.

Their objection seems to be based, first, on the impression that it would take the place of the regular established labor organizations; and, second, a distaste for Government participation in negotiations and settlements between employer and employed, which the Whitley plan contemplates in certain situations.

Some of the strong and thoroughly organized labor unions, such as the Coal Miners' Union and the Amalgamated Society of Engineers (metal trades), take the position that the machinery of the old established organization and the usual arrangements with the employers afford sufficient means of adjustment of grievances.

Old Established Systems.—In respect to a considerable number of industries both employers and employed explained that they had introduced the equivalent of the Whitley plan years ago. But it usually developed that their arrangements for conference and adjustment of differences between employer and employed did not include the district councils of the Whitley plan, and only in some industries regularly established joint industrial councils. Many of these individual mutual conference arrangements have been very effective in preventing industrial conflict. Some of them have been in operation for many years.

Fortunately, as some declare, England has been experimenting with methods for the betterment of relations between employer and worker so that opportunity has been afforded to witness results over a period of more than a generation. As

[1] *The first (interim) report of the Committee on Relations between Employers and Employed (the so-called Whitley Committee) was made on March 8, 1917, and is contained in Bulletin 237 of the United States Bureau of Labor Statistics, Washington, D. C. Subsequent reports and the memoranda by this committee are contained in the Monthly Labor Review of the same bureau for May, June, August, September and December, 1918.*

Labor leaders in the Government and leaders among workingmen outside official circles are coming out emphatically against theories of restriction of output.

Most British workers believe they do not benefit in a fair measure in the advantages which inventions and improved methods should provide to all members of society.

confidence was gained by experience, more rapid progress in later years was accomplished. The plan simply carries out and defines more accurately old-established machinery for the adjustment of labor disputes.[1]

The Whitley system was examined with special interest and care by your commission, because this plan is now being furthered by the British Government in the attempts to encourage the get-together spirit of employers and of conservative employees.

Period of Great Labor Unrest

In our interviews we were constantly met with the statement that we had arrived at a time of great labor unrest, and our investigations confirmed this view.

Interviews with many of the workmen tended to indicate that "unrest" is a rather inadequate term. There are many intimations of "direct action" and a complete overturning of the present social structure. But we believe the more extreme demands are largely limited to a class which has been thinking and talking along these lines for years.

The issue, however, is squarely drawn on the demand of the working people to have a better industrial day. They seek not merely small non-essentials, nor commonplace essentials, but a real step forward in their conditions of life and labor.

The relationship in Great Britain between employer and worker is clearly in a state of marked transition. This fact is recognized and accepted by all the country. This process was in its inception before the war and has been renewed with double intensity since the armistice.[2]

We Cannot Report That We Have Found Any Panacea for Industrial Unrest.—For instance, the specially generous treatment of employees, which is possible in connection with exceptional types of highly profitable enterprises, might be impossible in the case of industries engaged in closely competitive operations.

While we do not mean to infer that competition in any industry could be accepted as a reason for denying those engaged in it a reasonable standard of comfort, we did note that some employers, bounded by the horizon of their own experience, seemed to believe that they had discovered or invented methods and practices which will eliminate all industrial conflicts. Their special schemes may be perhaps successfully used under the special conditions of certain plants.

But in this report we are concerned only with principles that may be generally applied for the good of industrial workers, and of industry as a whole.

Causes of the Unrest

The present unrest among the workers is ascribed by different authorities to many separate causes—that most frequently mentioned as the *immediate* cause is the strain of four terrible years of exhausting war, necessitating the most intense labor and excessively long hours for the worker.[3]

Among other alleged causes is a feeling that the worker does not receive his proper share of the combined product of capital and labor. This is universally voiced by the workmen whom we have interviewed.

Workmen Criticize Their Unions—The present condition is partly due also to the fact that grievances through the unions must pass through a rather complicated series of steps, and this proc dure, therefore, does not result in prompt adjustment. Ofttimes the conditions contributing to the grievances have disappeared before the decision is consummated.

On the other hand, the shop stewards and committeemen, being in direct contact with the employer, usually succeed in promptly establishing accord between the parties concerned.

There seems to be a marked disposition among the "rank and file" of workers to criticize the present union system because it denies the workmen in the shop an opportunity promptly to rectify grievances, irrespective of their particular craft union. The object of the shop steward or shop committee movement appears to be to rectify this by constituting a shop organization capable of dealing with common grievances.

At the present moment there is rather a widespread feeling among the workingmen that the officials of the labor unions have become detached from the atmosphere of the shop and not in proper sympathy with the workmen. There is a marked disposition among the workmen to be represented in the national councils by actual workers.

The primary organization of unions has heretofore dealt with questions such as wages and hours of labor, which are common to the entire territory, while the shop committees or shop stewards deal with matters peculiar to their own establishments. Sometimes the members of the committee or the shop stewards are those among the men prone to be agitators.

Nevertheless the system seemed to work very well until now, when the men, under the leadership of the stewards and committeemen, are inclined to break away from the leadership and advice of the regular union officials. This condition has resulted in serious strikes and promises of others of still more serious moment to the general community.

All parties seem to agree that the present unrest, often resulting in grave discomfort to the community as a whole, is possible in certain circles only because energetic minorities are able to lead apathetic majorities of workingmen.[4]

Views Expressed by Workmen

Your commission, as stated above, devoted a number of evenings to discussions with different types of workingmen, getting expressions of many widely varied shades of opinion.

One cannot listen to their grievances and hear the stories of their troubles, as voiced by the more intelligent workmen, who are of a very superior type, without being impressed with their sincerity. Periods of unemployment frequently place them in debt, from which it requires years of strenuous effort and self-denial to recover. Many find themselves unable to obtain employment during their later years, after a life-time of constant industry; their wages afford slight means for recreation.

Most of the British workmen believe they do not benefit in a fair measure in the advantages which invention and improved methods should provide to all members of modern society.

The radicals contend that society as now constituted under the competitive system includes many wealthy idlers and a vast system of middlemen which stand between the producer, who is also in a large measure the consumer, and a just

[1] *At a large cotton mill in Lancashire it was stated that for years all differences in the industry had been successfully settled by joint committees, averaging 600 cases per annum. In another industry, no difference had arisen in five years which had not readily been settled without a strike. Another large concern told of 149 out of 150 cases being adjusted without a strike. In not a single instance did I receive an adverse report from either side in any plant where the plan had had reasonable time to become established.*—R. J. CALDWELL.

[2] *The workers, it was found, were greatly dissatisfied with wages, working hours, and housing conditions before the war. But after Aug. 1, 1914, the labor troubles were overshadowed by the greater crisis. Even during the war the workers continued agitation for better conditions. Now that military peace has come the industrial conflict threatens anew with increased vigor.*—R. R. OTIS.

[3] *The strain of the war is an incidental cause in our judgment. The fundamental cause, we believe, is the struggle for better conditions for workingmen. This fundamental is almost world-wide, and Great Britain appears to us as but the index, or perhaps the guide, of far deeper than nationalistic or temporary forces.*—R. J. CALDWELL and WM. H. INGERSOLL. *Shortage of proper amusements, housing, sanitation, and lack of general welfare work for the hundreds of thousands of demobilized soldiers who have either gone back to the shops or are idle, and continuation of some war restriction depriving the working class of many comforts, such as light, certain kinds of food, etc.—all this, to my mind, has had perhaps a more "immediate" depressing effect than some of the more serious, fundamental causes outlined above.*—R. R. OTIS.

[4] *It should be noted that this comment refers only to "certain circles" of labor.*—THE CHAIRMAN.

Less than 200,000 of the 14,000,000 British workers own their homes.

The average workman thinks quite as much of considerate treatment as he does of wages.

Business men freely declared that danger lay in the tendency to "wait for wages to go down" before going ahead with business.

share of what the workman produces. Many of them believe that all profits should be eliminated and that pure socialism is a cure for all their ills.

But when closely questioned along constructive lines they do not seem to have any workable suggestions of what the proposed new order of things should be.[1] They do not state whether or not it might result in a more just, proportionate distribution of the fruits of the combined operation of capital and labor or if it would result in a greater net income and enjoyment of the good things of life to the worker.

Workmen Now Study Economics.—It is obvious that a great amount of study by the workmen is being devoted to the subject and that a section of the younger workmen are being assiduously educated by certain radical groups along socialistic lines of thought. It develops that in one of the cities visited by us there are 14 classes devoted to the teaching of economics, and that a considerable number of workmen attend the classes regularly in preference to the moving picture houses or other recreations.

The theory that this movement is due to foreign propaganda does not seem to be generally accepted, although some employers voice the idea.

Minimum Standard of Comfort.—The more intelligent workers realize that merely advancing wages does not meet requirements if the purchasing power of money is thereby proportionately reduced. This was exemplified to their satisfaction by the experience of the war. Their final desideratum is a wage that will insure a specified minimum standard of living regardless of fluctuations in the cost of commodities.

The workers frequently mentioned the fear of the poorhouse. Security, they said, must accompany all plans to allay labor unrest.

Insurance and Pension Plans.—When asked what substitutes they had to suggest, the reply from quite a few was:

"Unemployment insurance."
"Health insurance."
"Old-age insurance."

These are the things, they said, which the provident would secure for themselves if their circumstances would permit.

It was apparent that the workman thinks quite as much of considerate treatment as of wages, and almost universally the idea was voiced that he is regarded by his employer merely as a "hand" or a number. He feels entitled to consideration and courtesy and very much desires closer *touch and sympathy on the part of the employer. In fact, this phase of the question was usually emphasized by the workman. The little things count, and their neglect magnifies them.*

Lack of Better Opportunity.—The average employee in Great Britain does not expect to rise above the station in which he was born, although a considerable number do become "masters," usually in a small way. Their expectation of always remaining in the same station results in a disposition to think in terms of class rather than individually and tends more toward organization than in America. It makes the British workman less inclined to individual effort than the American workman.

Short Hours of Labor.—The question of short hours of labor was one of the most prominent in all our discussions. In some of the plants we visited the men worked about 54 hours a week—some work more and some less—but one great and successful engineering works adopted an 8-hour day (48 hours a week) 20 years ago. The men in the engineering trades are now working a 47-hour week. They asked for a 44-hour week, and some, in an attempt to provide, as they thought, promptly for a greater number of workers in order to meet the temporary dilemma of unemployment, are now asking for a 40-hour week.

Perhaps a definition should be given of certain phrases current in labor circles of Great Britain, in order that the views of the workmen may be better understood.

Definition of Voice in Management.—Of special significance is the expression, "voice in management." According to the preponderant view of both employers and employees in Great Britain, this phrase signifies only that workmen or their representatives should be heard in connection with the management of matters intimately affecting the workmen, such as the hour of beginning the day's work, a matter on which the shop committees want to be consulted (not length of hours, which is a question for collective bargaining between the unions and the associations of employers), sanitary conditions, safety matters, etc.

In the mind of the average British workman, the phrase "voice in management" does not, therefore, as at present generally understood in America, extend to matters purely commercial or administrative, nor to such questions of business policy as expanding to new markets, purchase of material, selling prices, additional investment in plant, etc. In other words, this phrase pertains to what we call "shop conditions." It does not extend to what are sometimes termed matters of organization and administration.[2]

Definition of "Capital and Labor."—In the expression, "Capital and Labor," the former term as used in Great Britain includes only the stockholder, who is usually an absentee proprietor, even in a close corporation, visiting the works perhaps once or twice a year, if at all. The term "worker" includes everyone contributing to the actual management or prosecution of the business, from the managing director down through superintendent, salesman, office workers, to the men who sweep the floors; emphasis being placed on the fact that "labor" includes both brain workers and manual workers.

The Problem of Housing

Among other matters having direct bearing on labor unrest, we gave our attention to the question of housing. The British Government appointed last year a royal commission to inquire into industrial unrest, and their report was to the effect that bad and insufficient housing played a large part.

Your commission also finds that Great Britain includes in its claims of having fourteen million workmen a large number of clerical men and women in railroad, telegraph, telephone, hotel, and even active clerical men in industrial plants. Out of this 14,000,000 only a very negligible number own their homes. Labor officials approximated the number at less than 200,000. Government officials questioned were uncertain as to the number of laboring men who want to buy homes, while leading realty agents advise it was so insignificant they did not even equip their offices to handle this class of investor.

Reasons for Housing Situation.—They gave numerous reasons for this situation, but the leading ones seemed to be: First, the vested title to land; second, long ground-rent leases, and third, the construction of rows of tenement houses which contained no permanent dividing walls.

Any of these causes would preclude the possibility of conveying to the workman who desires a home an absolute, permanent (fee simple) title to both land and to building.

Other reasons put forward were that the laboring class seldom appeared to have any surplus for home investment, while others did not desire to become identified with any given location, or, expressed differently, tied to any one industrial establishment by virtue of owning a home.

In contrast, it is pointed out that

[1] *It is a matter of opinion as to whether their plan is workable or not. I do not believe it is, but they do; and they are not without a comprehensive scheme of social and industrial organization.*—WILLIAM H. INGERSOLL. *The writer of the text in the report refers to our talks with many men who work at the bench. It is assumed that no one denies that some of the leaders have clearly defined plans.*—THE CHAIRMAN.

[2] *The above states the idea as commonly expressed to us by many workers. In the language of other workmen, "voice in management" means actual share in the conduct of business. The term has an indefinite variety of meanings.*—THE CHAIRMAN.

American workmen and clerical men not only desire to own a home but that large numbers of them make every effort in that direction.

Well-posted Englishmen of affairs tell us that in new countries like Canada, Australia, etc., there is a condition similar to that in the United States.

Need of 300,000 *Homes.*—The British Government now figures the urgent need of from three to four hundred thousand houses for laboring men, and this development is supposed to get under way at once. Yet, under the various housing acts in effect since 1890 the actual construction is as follows: 1911, 464 houses; 1912, 1021 houses; 1913, 1880 houses; 1914, 3335 houses; 1915, 4408 houses.

Also, under these acts individually owned houses of the slum type were made fit by partial condemnation and at the expense of the owners, beginning with 19,463 in 1911 and increased to 67,065 in 1914. Many of these buildings were to take care of war workers.

None of the English housing acts seem to have for their aim the idea of encouraging the workman to own his home, but are almost exclusively rental propositions.

The British Government's present reconstruction measures of underwriting the loss of the present-day cost of building 300,000 houses as opposed to their value seven years hence is a system elaborate enough to warrant special study. But this again does not aim at making the laboring and clerical man or woman a vital part of the community through personal ownership of his home.

No Restriction on Output

A subject constantly discussed in our interviews with Government officials, employers and workingmen was the question of restriction of production and the introduction of labor-saving machinery.

Great emphasis was placed on this topic by the British. The employers naturally plead for high production. Government officials are indorsing this plea; and what is more, the labor leaders in the Government, and also leaders of workingmen outside of official circles, are coming out emphatically against theories of restriction of output.

Again, on this subject, as on others, the radical element stands apart. Some of those who want a fundamental change in society say that under the capitalistic system labor cannot in any event get more than a bare subsistence, and that increased production is simply for the benefit of the capitalists.

"Nation Must Produce to Live."—All others, however, including a large number of those of the "rank and file," so-called, of the workingmen are preaching that the nation must produce in order that the nation may live; and that workmen cannot share in what is not produced.

Practically all labor representatives who believe in continuing the present system of society agree that increased production is in the interest of both employed and employer.

Most of those who favor short hours claim that this is merely for the benefit of the health of the working classes, and arguments are now rife as to whether the total output is decreased or maintained at the same level by a reduction to 48 or 47 hours.

Employer May Be Penalized.—We also found that by agreement between organizations of employers and organizations of workingmen in some highly organized industries, such as the cotton industry, a case may be filed against the employer who, because of bad raw material, is not able to procure a standard output. Such an employer may be penalized by having to pay higher wage rates, so that the workman may make the usual earnings at the prevailing piece-work rates, in spite of poor raw material.

Miscellaneous Topics

Equipment of British Plants.—The various industrial plants inspected indicated that the equipment and organization of the British plants compare favorably with corresponding plants in the United States. It is an interesting circumstance that a very large steel-producing plant in course of construction contained many trains of machinery manufactured in the United States, and the balance of its equipment was built in England under license from and under the supervision of the foremost American designers. Plants developed wholly under British auspices, as a rule, represented a very high state of development.

A Co-operative Organization.—We visited one of the great co-operative commercial organizations which produce and distribute at wholesale and at retail many articles of ordinary consumption. Its turnover amounts to over $60,000,000 annually, and it is not the largest organization of the co-operative type in Great Britain. It operates oil wells, raises tea, manufactures shoes and many other articles. The co-operative feature of this institution pertains mainly to the commercial end of it. Most of the employed are not interested in the institution, although they may purchase a limited amount of stock if they desire. Therefore the labor problems of this co-operative institution, as the managers themselves stated, are similar to those of an ordinary industry.

Holding Back on Non-War Production.—There appears to be in Great Britain hesitation on the part of various enterprises to reconvert to and to go ahead with non-war production. Reasons given are, first, the fear of turmoil in the labor world, and, second, the expectation of lower prices of material and lower wages. It was widely stated that there seemed to be no sound economic basis for the latter expectation.

Business men freely declared that danger lay in the tendency to "wait for wages to go down" before going ahead with business. One of the largest employers in Great Britain, seconded by several others, said that if there was reason to fear serious industrial unrest, it lay largely in this waiting tendency caused by threats of labor disturbances.

Women in Industry.—Women played an important part in industry during the war. There was opposition from workingmen, but this was partly overcome by inviting the female relatives of the workingmen to the plants.

Many people in Great Britain believe that the returning soldier who was replaced by a woman should not now be kept out of his position; hence, hundreds of thousands of women are expecting to go back home or into domestic service.

However, some of the labor leaders themselves, and especially labor men who are now working for the Government, call attention to the fact that equal pay for equal work on the part of women should properly mean equal pay for equal value; that therefore women need not draw the same pay per hour as men; as otherwise women when not capable of delivering equal value would be crowded out of employment.

Improved Conditions of Workingmen.—It seems obvious that during the last hundred years the condition of the workingman in Great Britain has been gradually improving, and that the war will result in acceleration of this process, so that in a few years more progress will be made in a short time than in fifty years of the ordinary course.

Unemployment Insurance.—The unemployment insurance benefit, amounting to 9s. ($2.18) per week for men, and 5s. ($1.21) per week for women, have been superseded for the time being by the temporary out-of-work donations granted by the Government to take care of unemployment growing out of demobilization of the army and of the munition factories. The out-of-work donations amount to 29s. ($7) per week for men, and 25s. ($6.05) per week for women. (The union strike benefit in the engineering trades is about half as much.) In addition to the out-of-work benefits paid by the Government the trade unions pay such benefits, varying from 5s. to 10s. ($1.21 to $2.42) per week.

Minimum Wage.—In Great Britain a minimum wage is established by agreement in the sweated industries, and enforced by the Board of Trade, fines being imposed for violation.

Attitude Toward Ministry of Labor.—It was a matter of some interest to note that while the workingmen seemed to believe that the ministry of labor is pro-capital, the employers seemed to believe that the same department is pro-labor.

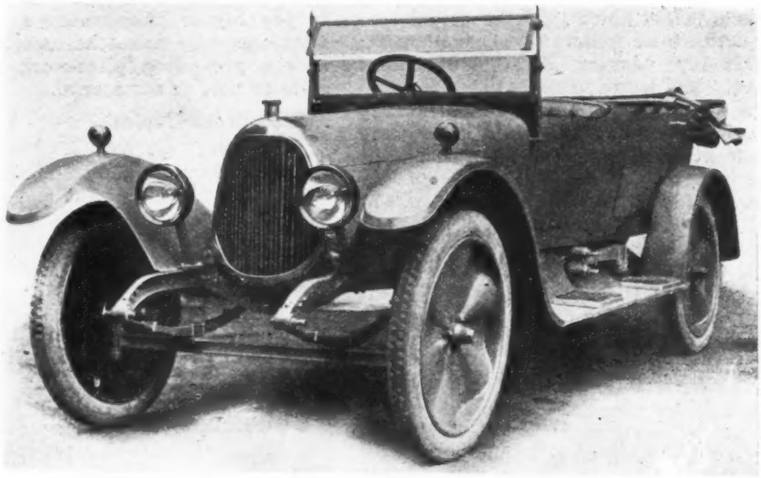
Compulsory Arbitration in Australia.—We were fortunate in meeting on the ship going over Mr. G. S. Beeby, minister of labor for New South Wales, who explained that in his country labor legislation had progressed very far, including compulsory arbitration, special labor courts, unemployment compensation, etc., but that at present the tendency in his country was in the other direction as regards compulsory arbitration, and that it was the general belief that this kind of arbitration had served to intensify labor disputes and increase strikes.

Other Topics Not Covered.—To report even briefly all the matters which came to our notice or indicate all the persons, interviews, and the source from which information was obtained would indefinitely extend this report.

The Angus Sanderson Car

A New British Assembled Product Embodies an Engine with Slipper-Type Piston, Counterbalanced Crankshaft, Integral Cylinder Block and Top Half of Crankcase, and Force-Feed Lubrication—Also a Novel Front-Axle Design

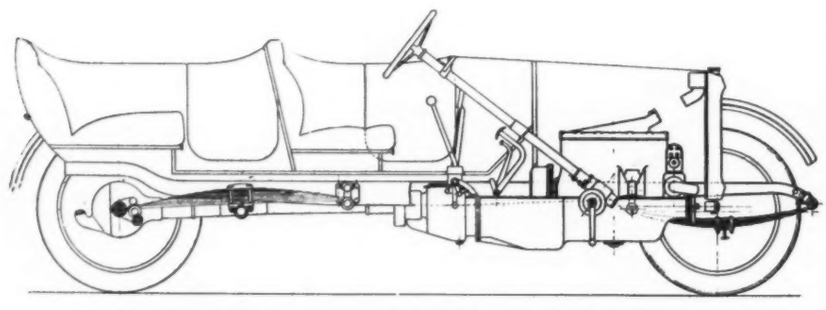
IT is about 10 years since a fair attempt was made in Great Britain to assemble a car from parts made entirely by outside firms, but in which the concern responsible for the car checked up all materials entering into the production of the parts, and in which the limit-gage system of manufacture was used. Such a car was the Weigel, which was virtually a copy of the 40-hp. Itala of that period. That the Weigel car passed off the market was through no fault appertaining to its method of production, for it was an excellent car. After an interval of some years, during which no cars had been assembled from specialized components in Great Britain, a light car produced on these lines is now about to be placed on the market, and it is an interesting coincidence that Frank Woollard, who was the designer of the Weigel car, is also connected with the production of the new car. Mr. Woollard, who during the interval had been associated with the Wrigley Co. of Birmingham, is the apostle of the assembled car in England.



The Angus Sanderson, a new British assembled car

The Angus Sanderson car, to which reference is made in the above, is the product of Sir W. Angus Sanderson & Co., Newcastle-on-Tyne, which has hitherto been engaged in coach building. In the car enterprise the firm has associated with it the Wrigley Co., which will furnish the transmission and the front and back axles; and the Taylor Co. of London, which will supply the engines. Minor components are furnished by other firms. The new car will weigh about 2700 lb., and, equipped with a full roadster body by the Angus Sanderson Co., electric starting and lighting systems, a spare wheel and spare tire, will sell at £450 ($2,250). The wheels are of a new type, with corrugated disk centers, and are said to be considerably lighter than tubular-spoked metal wheels.

Other features of interest in the design are the Ricardo slipper type aluminum alloy piston; the front axle, which is patented by the Wrigley Co., and has T-shaped steering knuckles; also the fact that, with the exception of the central or fulcrum bearing of the rear cantilever springs, all bearings have oil lubrication instead of grease lubrication. The fulcrum bearing referred to is lubricated by means of graphite grease, which is inserted into a hollow pin, which is claimed to hold enough for several months. Interest also attaches to the design of the rear axle, which has a spherical center casing with recessed bolt holes, the object being to obviate all offsets and corners which would tend to retain mud. The differential driving gear can be removed through the back of this housing, and the axle shafts can also be withdrawn without taking the axle down, the latter being of the full-floating type. The lubrication and cleanliness features are of particular importance because the car is specially designed for owner-drivers. It is being fitted with a body which, made before the war under the old-fashioned hand method, would have cost about £150 ($750), and if made now according to the same method would cost about 50 per cent more. The panels are shaped under hydraulic dies, and electric and acetylene welding are being used in joining panels together and for attaching valances and mudguards. The latter are domed and without angled edges.



The chassis of the Angus Sanderson in elevation

An output of 6000 cars is scheduled for the first year, and it is stated that about three-fourths of that number have already been taken up by dealers.

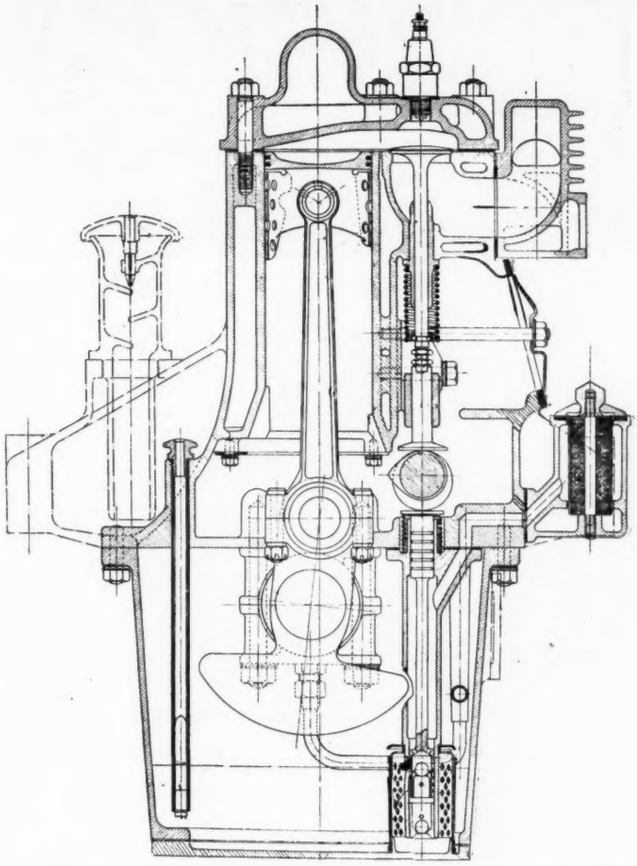
The general design embodies features associated with quantity production practice, but, as the sectional view shows, this is attained without sacrificing stability or a suggestion of the cheap. Details that are new in British car construction include such points as (1) combination of block cylinders with the upper part of the crankcase; (2) careful balancing of the crankshaft by means of counterweights; (3) the sup-

pression of noise (a) by using a specially rigid crankshaft with large journals, and (b) specially cut helical timing gears with cross-gear driven magneto; (4) effective carburetion by a "hot-spot" manifold; (5) specially light pistons of cross-head form (Ricardo's system), with hollow piston pin in a floating bearing, the combination weighing but 12 oz. as compared with 2 lb. for an average cast-iron piston; and (6) the front-axle design and certain details of the rear axle.

The Engine

The four cylinders are block-cast and combined with the upper portion of the engine case. They have a demountable head, valves at the side in common file, and are wholly inclosed by a pressed sheet-metal cover, externally removable tappets with mushroom ends in direct contact with the valve cams. The bore and stroke measure 3 by 5 in. and the S. A. E. rating is about 13.9 hp. Access for removal of the pistons and rods is either through the cylinder top or through the base, which is covered by a large plate. The lower part of the crankcase is of aluminum. The sump has a bottom cover which gives access for the easy removal of the pistons and rods. There are three main bearings for the shaft, with provision for the direct lubrication of each by a plunger oil-pump driven by a cam on the valve shaft. This pump also delivers oil to the timing gears. The latter are of cast iron with helical teeth. The magneto is carried transversely on a bracket and is driven through a flexible coupling by a cross-geared shaft. At the opposite end of the casing is the Lucas dynamo with its armature fore and aft, so that the pulley comes in line with the fan-pulley shaft, both members being driven by a pair of side-by-side pulleys of different diameter on the front end of the engine shaft. The Lucas electric starter is bracketed with the armature fore and aft on the off-side rear corner of the engine, and has pinion engagement for the flywheel periphery, the teeth in which are cut from the solid, the wheel being given an increased diameter for the purpose, corresponding with the width and diameter of the teeth. Both dynamo and starting motor are held in place by a lock-strap across the middle of the cases.

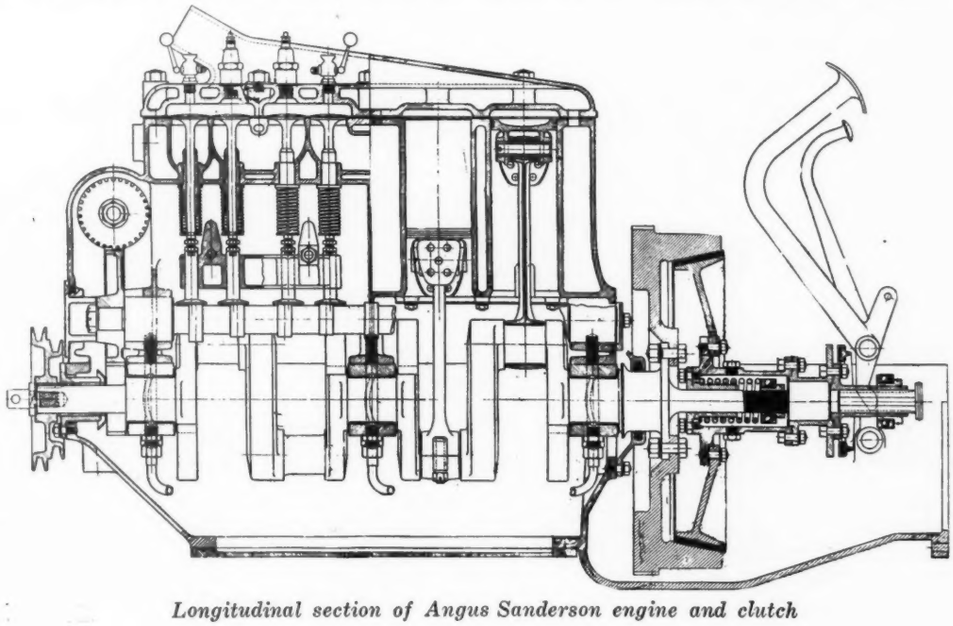
The carbureter is the Zenith, with a horizontal choke-tube and gravity feed from a 7-gal. tank placed under the dash, or, to be exact, fashioned symmetrically so



Section of Angus Sanderson engine, showing method of forced lubrication

that it forms, so to speak, a continuation of the bonnet curve. The tank has a 3-in. filler cap at both corners, this to facilitate filling and to provide access for cleaning, etc. The water circulation is laid out with the object of insuring ample cooling where most required—about the ignition plugs and the valve throats; also having regard to the reliance on a gravity displacement for its circulation. The radiator is of the vertical tubular form.

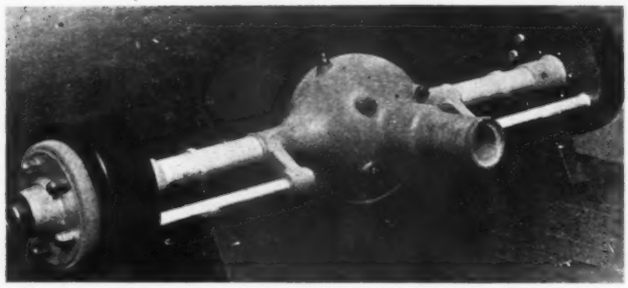
The magneto is of Thomson-Bennett make and has variable timing. Spark and throttle levers are grouped together on the steering post and instead of the conventional toothed sector, a friction lock is used.



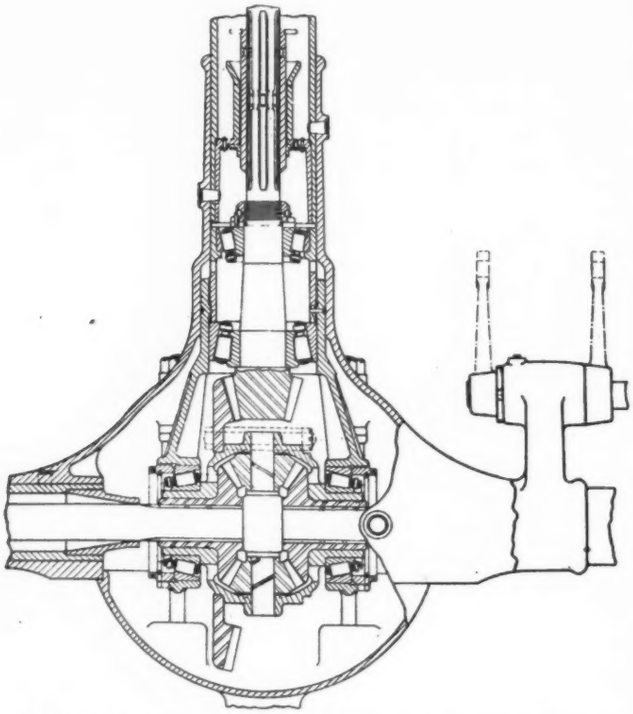
Longitudinal section of Angus Sanderson engine and clutch

Transmission and Drive

The engine and gearbox are a built-up unit. The clutch is an external cone faced with fabric and made readily demountable by removing some four through-bolts in the clutch members. Clutch rings and arms are one member bolted to a flanged center or boss. The clutch and brake pedals are adjustable. It will be noticed that the clutch spring is inclosed in the



Angus Sanderson rear axle with twin side-by-side brakes



Sectional view of the Angus Sanderson rear axle gear housing

flanged casing and that there is a ball thrust behind this spring and another behind the heel of the pedal. There is also a clutch stop or disk brake, and special provision to prevent escape of the lubricating oil from the engine case into the gearcase, and vice versa.

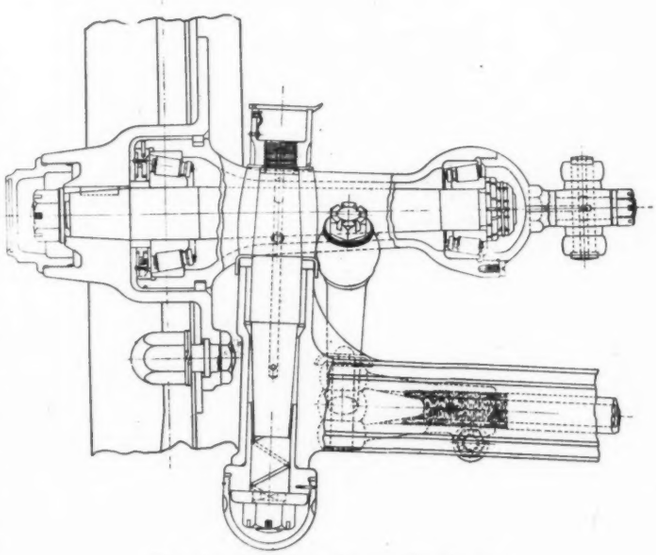
There are three speed gear changes and a reverse, the top speed being the usual direct drive. The primary or sliding gear shaft is carried in ball bearings, except the pilot, which has a floating bronze bushing. The layshaft is carried in bronze bearings and is below the primary shaft. Provision is made to insure the continuous circulation of oil (a thin quality is used throughout this chassis) and to prevent splashing and loss by leakage. The vertical sleeve in which the speed lever works has provision against idle play and clatter and serves as a vent for the heated air. There is provision also in the sliding rods against more than one gear train being meshed simultaneously. The gear ratios are progressive in the order of 4.2 to 1 (top, which is also the back axle gear ratio), 6.8 to 1 (second), 13.8 to 1 (first), and 18.4 to 1 (reverse).

The rear axle unit is a composite of cast steel (center and brake carriers) and wrought sleeves (axle housings). The center casting or axle gear differential box is spherical and devoid of flanges and projections liable to collect mud. Access to this case is from the rear by a cover held with four nuts. By undoing four nuts in the front of the center case the whole of the differential, crown wheel, and bevel pinion, together with the bearings, can be withdrawn from the car case for examination. A micrometer adjustment is provided to the crown wheel and bevel pinion, by which it is possible to obtain an adjustment to within practically one thousandth of an inch. A bevel differential is used, there being two star pinions. A special arrangement exists to prevent the oil leaking from the center case, except in predetermined quantities. It is possible to withdraw the differential shafts by means of a jack nut, which, when rotated, pulls the shaft from the hub shell, the taper on the shaft being reversed to permit of this. The hub shell is held in position by means of the journal bearing and a bush which is free from the hub shell except when the axle shaft is withdrawn. Goodyear detachable wheels of a novel corrugated disk form are used with 815 x 105 mm. Wood-Milne rubber safety tread tires having extra thick treads. The steering wheel has an Exonite-covered rim. The bearings to the swivel pins are widely spaced, and the hubs are carried on rotating stub axles which, it is claimed, practically is equivalent to the semi-floating type of rear axle shaft. Thus it is possible to spread the bearings from twice to two and one-half times the usual amount of spread allowed in the normal type of axle, besides enabling more adequate provision against moisture and grit, and also enables the axle to be lubricated from two points only.

New Rust-Proofing Method

PROF. BARFF in a Swiss engineering journal publishes a method of protecting iron from rusting that is more durable than any yet known. The iron to be treated is exposed at red heat to the action of superheated steam. This gives a surface coating of black iron oxide that is a complete protection against rusting. The protection thus afforded depends on the temperature of the steam and the length of the treatment. The coating is very hard, adheres very firmly and shades off inappreciably into the changed mass of the iron.

If the iron is exposed in a chamber heated to 260 deg. C. for 5 hr. and acted on by superheated steam, a coating is formed that will withstand the action of emery paper for a considerable time. If the temperature is raised to 650 deg. C. and the time of treatment to 6 or 7 hours, the surface coating will resist the action of a file.



Front axle end of Angus Sanderson

Gears for Tractor Construction*

Materials and Dimensions—Importance of Using High Grade Steel on Account of the Resulting Compactness of the Transmission and the Greater Facility of Enclosing It

By E. J. Frost

THAT the tractor has come to stay and is going to be an important factor in the future development of the world, from an industrial and agricultural standpoint, few will dispute. That its manufacture and sale will add tremendously to the wealth and prosperity of those countries capable of producing and marketing it in any considerable quantities, also needs no debate. That the tractor of to-day has in any large measure reached its ultimate development and will satisfy the needs or ideals of the future is very much open to question.

The histories of the passenger car and the truck both point to development covering a period of years, and, judging from the new features brought out each year, the end is not yet. It is therefore unreasonable to suppose that in the short time of experimenting and trying out in actual field service a mechanism will have been developed that will measure up to the requirements of the future.

Fron an engineering standpoint the problem seems to have been approached mainly from two different angles, due to the previous training of what might be called separate schools of engineers. Naturally one of the first to enter this field of endeavor was the man having had training and experience in making agricultural implements, with very little or none in engine, clutch, transmission, differential and radiator design; and it is natural to expect that most of the thinking of this type of engineer would be strongly biased by the previous experience with horse-drawn agricultural implements.

The other type came, naturally, from the passenger car and truck manufacturing interests, and while he might have had all the experience and ability necessary in connection with the power end of the problem, he naturally was lacking in the lore of the implement man.

The Biased Implement Man

It is natural that the implement man should be biased toward the use of cast gears and unprotected internal gears and chain drives, and that to many such strength and ability to resist wear should be represented only by cast-iron, malleable, or possibly steel castings, in most instances large to the point of being cumbersome, and frequently incapable of being properly housed to retain lubrication and keep out dirt.

The subject of upkeep, cost of repairs and accessibility of the parts is going to be given increasing attention by future buyers, and it behooves designers to spend any amount of thought and time necessary to attain the desired ends.

A careful analysis of the physical properties of the cheaper materials sometimes used, as compared with even medium priced alloy steels, will disclose the fact that smaller gears and shafts can be used, giving equal resistance to wear and shock and permitting assembling in much smaller housings, greatly facilitating protection from dirt and making it much easier to apply proper lubrication. I assume, too, that frequently these substitutions can be made with little or no increased expense, due to the decreased size lessening the machine work, and the decreased weight of setting the increase in cost per pound.

In a paper of this character time will not permit of an extended discussion of the varied requirements to cover the entire gamut of tractor design, as in all probability each case would have to be analyzed by itself, taking into account the power, speed, drawbar pull, weight and any other items affecting the required strength; and possibly considerable experimenting and field trials would be necessary to determine proper sizes.

It is apparent even to the casual observer that both extremes have been reached, and it is evidently unfair to ask a successful manufacturer of gears to, on the one hand, put his trade mark on and guarantee the durability of another man's design, known to be wrong, because too light, and, on the other hand, compel him to equip his shop with machinery for cutting teeth of a size so large and overpowered as to make it only a question of a season or two before a decided alteration must take place.

Conferences of Engineering Staffs

It would seem, therefore, that the best interests of the tractor manufacturers would be conserved by conferences of their engineering staffs looking, as far as possible, toward standardizing design and materials of construction, in an effort to improve the general average and increase the confidence of prospective buyers.

It also might not be amiss to call for such help as the American Gear Manufacturers' Association can give, and I am sure that I voice the sentiment of those here when I say that we would give nothing short of the best we have.

A carefully made 3½ per cent nickel, low carbon steel suitable for case hardening may safely be used for tooth pressures way in excess of common open-hearth steel, and the same is true of chrome nickel and chrome vanadium; the latter, however, in the hands of those inexperienced in its heat treatment to secure machinability may find considerable difficulty in maintaining uniformly good results, and have to slow down so much in making and cutting the blanks that the work becomes unprofitable.

Higher carbon (40-50) chrome nickel may also be used in many instances, with good results, as such material can be heat treated to give the required physical properties so far as tooth strength is concerned, and when properly made by the mill will give good wearing service, although soft enough so that a new file will bite the teeth.

The only trouble I have found with a steel of this

*Paper read at the American Gear Manufacturers' Convention at Cleveland, April 14-16.

analysis was destruction of the contact surfaces of the teeth due to what is termed "pitting," and the only explanation we could find for our difficulties was that something had gone wrong in its manufacture at the mill.

The chemical analysis showed material up to specifications, and the microscope revealed nothing that we could assume pointed to trouble. However, the trouble existed and in our effort to eliminate the difficulty we experimented with steel of the same analysis, but with the carbon content increased from 0.37 to 0.45.

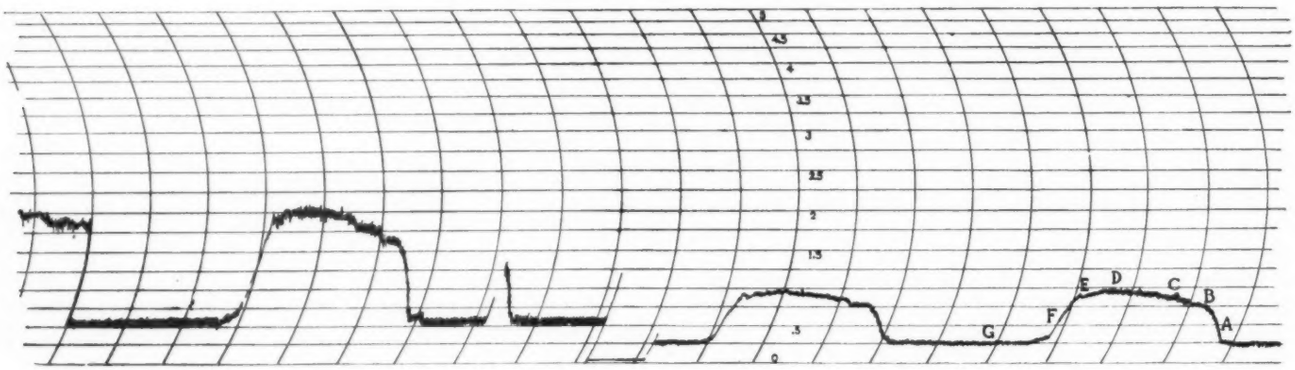
This did not remedy the pitting, and I went so far as to take out a set of gears from an automobile transmission after having been driven 20,000 miles and showing no appreciable wear, and substituting a set made from the chrome-nickel steel of 0.45 per cent carbon, and with the scleroscopic hardness, checked by the Brinell machine, considerably raised, and these failed, showing considerable pitting in 500 miles.

It is therefore evident that where steels are to be used that in service will approach the destructive limits, great care must be taken to see that not only do they check up as to chemical analysis and physical properties as originally determined, but that experiments should be made to satisfy us that the individual batch of steel under consideration will stand up under the proposed load, speed and other conditions.

My criticism of what I saw at the Kansas City tractor show is along two lines: first, there was such a multiplicity of levers, reach rods, valve tappets, links, chain drives and in too many instances gears unprotected from dust and grit, that if an owner spent most of his time wiping up, the tractor never would be clean. Second—and to my mind a serious matter—the bull gears and main drive pinions and frequently other gears, were left unprotected. I imagine this was due to excessive size, which can be corrected only by using better materials of construction which will permit of adequate protection without making the housings too cumbersome.

Electric Graphic Meter for Testing Machine Characteristics

Fox Machine Co. Makes Use of Meter for Testing Finished Machines—Power-Consumption Characteristics of Drill Presses Clearly Brought Out



Sample strip of tape from the Esterline Graphic Meter used in the plant of the Fox Machine Co. for determining power consumption of machine tools. This tape illustrates the characteristics of a multiple spindle machine drilling six ½-in. holes in a 1¼-in. cast-iron plate

AN interesting use of the recording wattmeter is made by the Fox Machine Co., Jackson, Mich. The instrument is an Esterline graphic meter and is used for determining the characteristics of finished machines. This company manufactures multiple-spindle drills, milling machines, etc., and it finds graphic records of this kind valuable in determining whether or not the characteristics of the finished machines are as required.

The machine is put on the test stand and the recording meter is connected with it. Then the machine is started, and the power consumed while the machine is doing a typical piece of work is recorded. The record illustrated herewith is from a multiple-spindle drill with six ½-in. drills going through a 1¼-in. cast-iron plate.

In reading the charts, proceed from right to left. Space between the curved lines represents time, and vertical space above the base line represents electric energy in kilowatts.

There are two characteristic curves shown on this sheet, the first being on a scale of one to four and the second on a scale of one to two. That is to say, the records of the curve on the right must be multiplied by 4 to get the correct result in kilowatts, and with the curve on the left the scale readings must be multiplied by 2 to get the consumption.

Both these curves show similar operations. Passing along from right to left it will be seen that as soon as the drills strike the plate the current drawn rises in a practically straight line to a certain value, and then there is a great reduction in the rate of increase. That portion of the curve marked A is where the drill is entering the cast-iron plate.

At point B the drilling operation is well under way, with the full diameter of the drill cutting. It will be noticed that at C on all of these curves there is a slight deviation, which seems to be characteristic of the drilling

(*Continued on page* 930)

Post-War Finance and Our Export Trade

The Effect of the Removal of Governmental Support on Sterling and Franc Exchange—Our Opportunities and Obligations Growing Out of Our Large Foreign Loans

THE American business man is awakening to a realization that the prosperity of the country depends to-day upon increased production. With this realization, and resulting from it, comes also the understanding that we must expand our foreign markets instead of letting them contract. So said Mr. Francis H. Sisson, vice-president of the Guaranty Trust Co. of New York, in an address on our post-war financial problems before the recent Industrial Conference of the New York Business Publishers Association.

In view of this fact, the withdrawal of governmental support from sterling and franc exchange presents one of the most immediate and vital post-war financial problems. It concerns the importer and the manufacturer of domestically consumed products as well as the exporter and manufacturer of goods which are sent abroad, for it establishes an invisible tariff against American goods in England and France, which, sooner or later, but inevitably, said Mr. Sisson, will affect our domestic trade.

Our large foreign loans also present huge problems. Our prosperity, said Mr. Sisson, is now, more than ever, contingent upon the prosperity of other nations. We must understand that our large war-time loans to foreign countries can never be recalled. We have permanently invested abroad. We must also invest a large portion of the interest due on foreign loans in foreign securities. We must help our debtors to rehabilitate themselves; but in doing so we shall be helping ourselves.

There are grave responsibilities in investing in foreign securities, particularly for those who are not experienced at it. Our banks, said Mr. Sisson, realizing that they must assume a large part of this responsibility, are preparing for it by studying the problem carefully and enlarging their facilities for extending service along this line.

But more is needed, Mr. Sisson feels. The banks, and through them the investors, must be supported by the Government. The property rights of its citizens must be protected by the United States. American investors in foreign lands must be assured that, "regardless of the administration in power at Washington, their property rights abroad will be defended, if need be, scrupulously and sternly."

We quote from Mr. Sisson's address:

Despite the heavy financial burdens imposed by the war, America is confronted with an embarrassment of riches—at least so far as indebtedness to this country is concerned. And thoughtful business men throughout the country are beginning to realize that our position as the greatest creditor nation of the world has its serious disadvantages and responsibilities. We gradually are comprehending, also, that whether or not there shall be a formal organization of a League of Nations, we are bound to other peoples by innumerable and far stronger ties than those which any international covenant could impose.

There has, indeed, been no more convincing proof of this fact than that recently provided by the "unpegging" of, or withdrawing of governmental support from, sterling and franc exchange. The larger significance of what was seemingly only a financial operation is daily becoming more apparent. It marks in a dramatic fashion the shifting from a war to a peace basis, not alone in financing, but also in practically every economic phase of international relations. It is one of the most immediate, vital post-war financial problems, and concerns the importer and manufacturer of domestically consumed products as well as the exporter and manufacturer of goods which are sent abroad—for it creates an invisible tariff against American goods in England and France which, sooner or later, but inevitably, will affect our domestic trade. We are awakening to a realization that the prosperity of the country to-day depends upon increased production and, consequently, that it behooves us to expand our foreign markets, instead of letting them contract.

Our Recent Trade Balance

It is true that during January and February of this year the value of our exports has exceeded the value of our imports in record-breaking amounts. The statistics recently issued by the Department of Commerce show that our exports during January exceeded those of any other month in the history of the country, aggregating in value approximately $623,000,000, which was $57,000,000 more than in December, and $118,000,000 in excess of January, 1918. In February of this year our exports were valued at $588,600,000.

These are decidedly encouraging figures, but we must not be misled by a superficial consideration of their significance, and forget what such unprecedented purchasing abroad of our products entails. We cannot continue to ship such enormous quantities of goods overseas unless the buyers pay us for them. There are three ways in which they can settle their bills, namely, by means of goods or service, by gold, or by securities or other instruments of value.

If we are to increase our production, which, as I have pointed out, is necessary to the maintenance of our prosperity, we cannot take goods in full exchange for our products. Besides, we are nearer than any other people to economic independence, and do not need imports in anything like the quantities necessary to settle the trade balance in our favor.

We Do Not Want More Gold

Payment in gold is as impossible as it is undesirable. The value of the excess of our imports over our exports in January alone exceeded the total value of gold produced in all countries, except the United States, during 1918. In addition, we now hold more than one-third of the world's reserve of gold coin and bullion, having added about $1,500,000,000 to our store of the precious metal in the last four years. We could not with safety drain other nations of their remaining low stock of gold, if we would, for as we are already their creditors to the extent of about $12,000,000,000, it is imperative for us to help them maintain their currency on as sound a foundation as is practicable under existing circumstances.

The granting of credits to purchasers of our goods will very materially aid in solving the immediate problem of financing foreign trade, but, at best, it can be only a temporary expedient.

This expedient was necessarily resorted to on a colossal scale during the war, and England was able to weather so successfully the financial storm during the early stages of the conflict and to lend large sums of money to her less fortunate allies because she had extensive credits and investments scattered all over the world.

Before the war England had "invisible exports" amounting to approximately $1,800,000,000 a year, consisting chiefly of interest in foreign investments which totaled about $1,000,000,000. The toll from foreign freight carried in English ships netted her something like $800,000,000. So that while England apparently had an adverse trade balance in 1913 of $670,000,000, in reality she had a favorable balance to the extent of more than $1,100,000,000.

On the other hand, our favorable trade balance of $500,000,000 prior to the war was about equalized by our payment of interest and dividends abroad, freight rates, etc.

Then war came, and Europe, plunged into the most destructive of conflicts, needed in vast quantities the products of our fields, factories and mines. American securities held abroad were sold back to us in wholesale quantities, in order that munitions and supplies might be purchased with the proceeds; more than $2,000,000,000 were lent to foreign governments through private channels in this country, and subsequently, foreign governments floated large loans in our markets.

When we entered the war, the financing of our Allies was naturally taken over by the Government, which advanced credits to them to the extent of more than $9,000,000,000. There remains less than $1,000,000,000 of the fund appropriated by Congress for the purpose to be lent to our Allies.

And it is to meet the situation created by this circumstance that the Government is arranging to aid American export trade by advancing $1,000,000,000 through the War Finance Corporation. Without entering into consideration of the merits of this plan, it will readily be seen that it consists merely of the granting of credits for purchases here and, therefore, can only be in the nature of an expedient, even though the credits extend over a period of five years. Furthermore, if the value of our exports continues to exceed the value of our imports at the present ratio even $1,000,000,000 cannot be effective as a remedy.

While there has been no official statement issued by the British or French Government as to the reasons for withdrawing their support from sterling and franc exchange, respectively, one result is inevitable, namely, the curtailment of the purchase of American goods in France and England. This is probably one of the two principal reasons for the so-called "unpegging" of these exchanges. The other reason was doubtless the high cost of supporting pounds and francs at the figures at which they had been held prior to the withdrawing of Government support.

The Invisible Tariff

Both England and France realize the danger of piling up huge indebtedness for our products on top of the pyramid of such obligations already existing. They are well aware that by permitting exchange to take its natural course, the American dollar must inevitably be at a premium, which means, of course, that less can be purchased in France and England by the dollar than heretofore, and, consequently, buying of American goods will be discouraged. As I have remarked, an "invisible tariff" is thus created against our products. We cannot criticise England or France for taking this protective measure, particularly when we consider that the support of sterling exchange necessitated the purchase by British agents of between $3,000,000,000 and $4,000,000,000 worth of sterling in the American market during the period in which exchange was controlled by the British treasury.

As one English authority recently explained, England "had been bearing the burden of maintaining the relation of sterling to the dollar not only up to the day when the United States came into the war, but ever since. It has been very costly borrowing dollars daily or weekly at 5½ per cent in New York to pay for all the sterling bills offered in London at $4.76 per pound.

"A point often arises in the relation of debtor and creditor when it is the creditor, and not the debtor, who is on the anxious seat," this same authority observed, and he added, "I think that this is the case now in our relation with the United States. At any rate, I am satisfied that it is quite as much the interest of the United States to-day to maintain the relation of dollar to sterling as it is ours to maintain the relation of sterling to dollar, and it is about time to leave the exchange to adjust itself."

It might have been advisable, however, to have cushioned the shock by a gradual readjustment, but that would not have altered the fact that so long as our dollar is at a premium, this country will be a good one to sell in, but a poor one to buy from—which is the vital element not only in the present exchange situation, but also in the whole problem of financing foreign trade.

The Solution

The solution seems to lie, as I have indicated, in the purchase here of foreign securities. We may as well understand now that we can never hope to recall all of our foreign loans, and that, knowingly or otherwise, we have invested abroad on a permanent basis. There is no doubt about our having to invest abroad some of the heavy interest due on foreign loans.

But that should prove to be one of our greatest assets, as it proved to be one of England's when the unparalleled crisis of 1914 shook the foundation of civilization. It means also that we are in world affairs on a scale never dreamed of a few years ago—and we are there to stay. Comprehending that truth, we must take full advantage of it, not only for our own sake, but likewise for that of our debtors. Our prosperity now is more than ever contingent upon the prosperity of other nations. In helping them to rehabilitate themselves we are helping ourselves. And we are amply able to render the needed assistance in the form of foreign investments.

We possess the greatest national resources of any people on earth; our yearly income is greater than that of any other nation, we lead the world in production and commerce; we have the largest total of saving as well as the largest per capita savings—amounting in 1919 to $113.45 a person, and to a grand total of more than $10,800,000,000, which represents an increase of more than $2,225,000,000 since 1914. The amount of "free gold," that is to say of excess reserves, in the Federal Reserve System, which represents the surplus lending power of the system, is sufficient to support a reserve note circulation of more than $1,500,000,000, a significant index to our reserve financial power.

But investment in foreign securities involves grave responsibilities, particularly for the unitiated. Realizing that part of this responsibility will fall upon them, our leading banks, in anticipation of the service which they will soon be called upon to render, are now studying the foreign security problem with a view to affording their customers the largest possible share of protection.

Government Co-operation Imperative

The utmost care must be exercised in determining what foreign securities shall be offered to the American public. We shall have imperative need for expert knowledge of all factors behind these securities. Our banks can be trusted to do their part in this new field, but they cannot perform their functions fully and properly unless they and our investors have the support of our Government.

Aside from the material security which will guarantee the repayment of capital and interest, there is involved the question of property rights. These rights must be protected by the United States Government. It is high time that a policy which would afford such protection be formulated and put into practice—not perfunctorily, but actively and earnestly—so that our investors in foreign lands will be assured that, regardless of the administration in power at

(*Continued on page* 934)

Fordson Tractor Assembly Wholly on Progressive Plan

PART I

Parts Move from One End of Assembly Building to Other Along Moving Chain—Sub-Assemblies Fed from Side

By J. Edward Schipper

PRODUCTION of Fordson tractors is now running at the rate of 300 per day. A new plant, completely surrounding the present one, is being constructed, and as each new unit in the plant is finished it is occupied in accordance with a well-defined plan of expansion.

The entire works may be considered as made up of two departments, production and assembly. Each of these has been added to in turn. After the manufacturing facilities have been increased and the latest in tools and production systems installed, the manufacturing end will push the assembly, causing perhaps an extra shift on that department. At the present time, however, the pendulum has swung the other way, and what will practically be the ultimate assembly system of the plant has just been put in operation.

The new method of assembly incorporates the latest ideas in progressive methods and goes beyond that of the Ford passenger car plant. The system is not yet completely in use, as the new assembling building is hardly a month old; nevertheless the principles are here and their description forms a wonderful story of up-to-date assembly methods as applied to tractor manufacture.

The assembly department occupies a long, rectangular building, approximately 1000 by 190 ft. Down the length of the building pass the chain systems used in assembling the principal units, so that the tractor starts at one end of the building in the form of rough parts and leaves the other end in the form of a finished tractor. There are two principal main assemblies to the Fordson tractor. One of these is the engine, the other the transmission housing. When these two are bolted together on the housing flange at the rear of the engine there is only little left to put on the tractor, outside of the radiator, seats, accessories, etc. This being the case, the assembly system is naturally laid out so that engine assembly and the transmission housing assembly travel along parallel lines until both are complete, whereupon the lines of

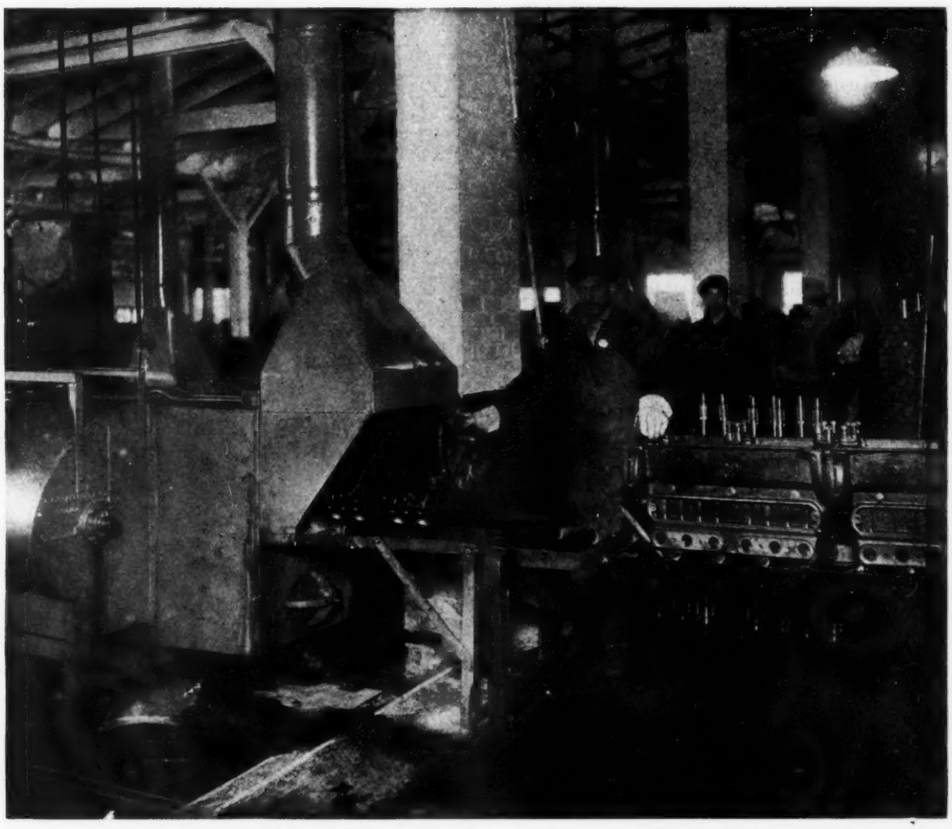


Fig. 1—Cylinder blocks leaving the gravity roller conveyor of the machine shop department and entering the assembly department through the washing machine

Fig. 2—Cylinder blocks leaving washing machine on overhead conveyors to beginning of assembly tracks

travel of the two units converge and they pass along the final portion of the assembly line together until they leave the end of the chain as completed tractors.

Assembly starts as soon as machining of the two large units is completed. There is therefore no necessity for storing such big parts as engine blocks, the large castings which contain the transmission and rear axle parts and the rear axle housings. The latter are large conical-shaped castings which cannot be stored conveniently.

The assembly department adjoins the machining department, so that the machine-shop conveyors which have passed the raw material along as it goes through each succeeding machining operation to the final inspection leave the final inspection department and directly enter the assembling department. The two long lines of assembly become apparent immediately at the entrance to the assembly building. One line takes the engine blocks; the other line takes the transmission housings.

Tracing the assembly through its various steps, we can follow the engine block from the time it enters the assembly building until it reaches completion, and then follow the transmission housings until they reach completion, where we will see how these are joined together to form the finished tractor. The tractors are then run under their own power into the paint shop, painted and sent off on their way. The large general map herewith will show how the assembly department is laid out, and this should be studied to get a general impression of the large rectangular assembly space with its track systems carrying the parts along, step by step, until they are completed.

The cylinder blocks leave the final machine-shop inspection room on the gravity roller conveyor and come directly to the beginning of the assembly line on this same conveyor. They have been completed in every respect and have the main bearings and caps in place. The machine-shop roller conveyor terminates at the beginning of the assembly conveyor and is shown in Fig. 1, where the fin-

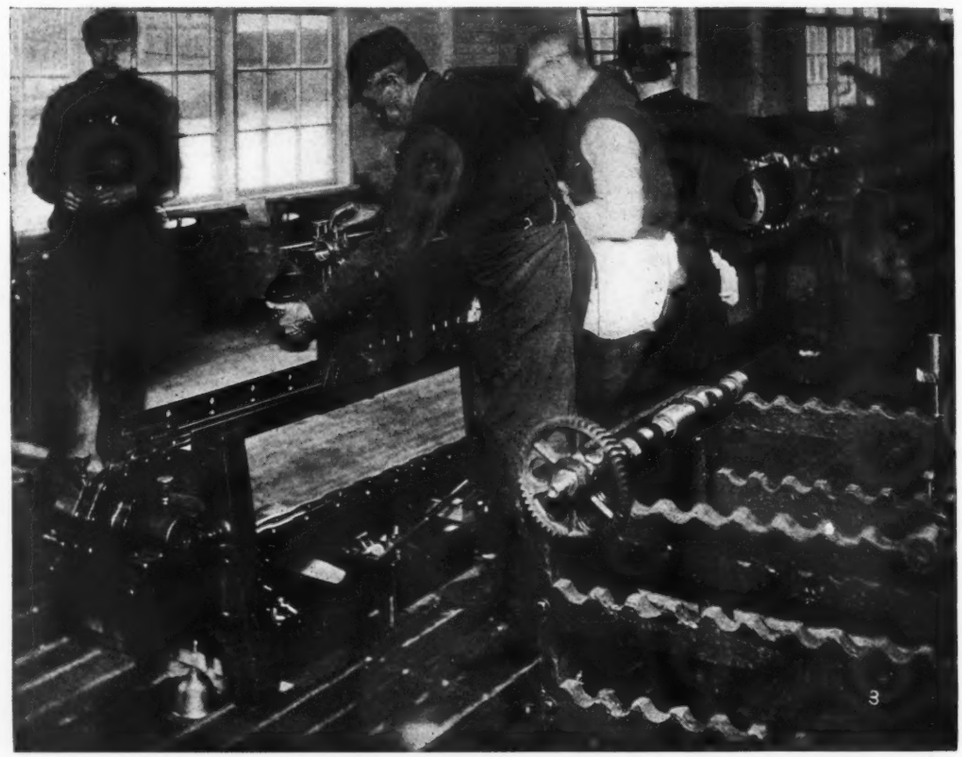


Fig. 3—The first step on the assembly chain is to fit the cam and crankshaft, meshing the timing gears properly. Note the rack for camshafts just behind the operator

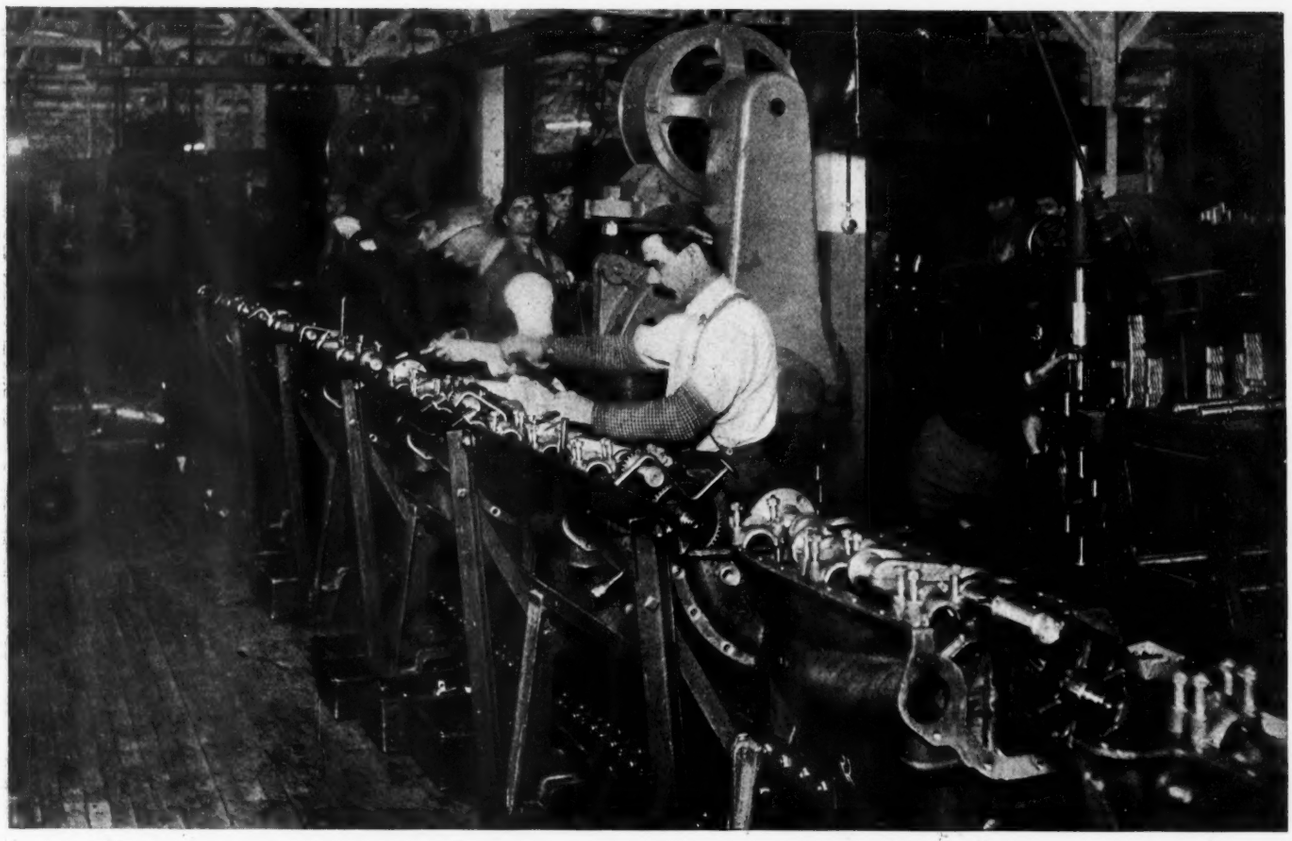


Fig. 4—First section of cylinder block assembly chain, where bearings are adjusted

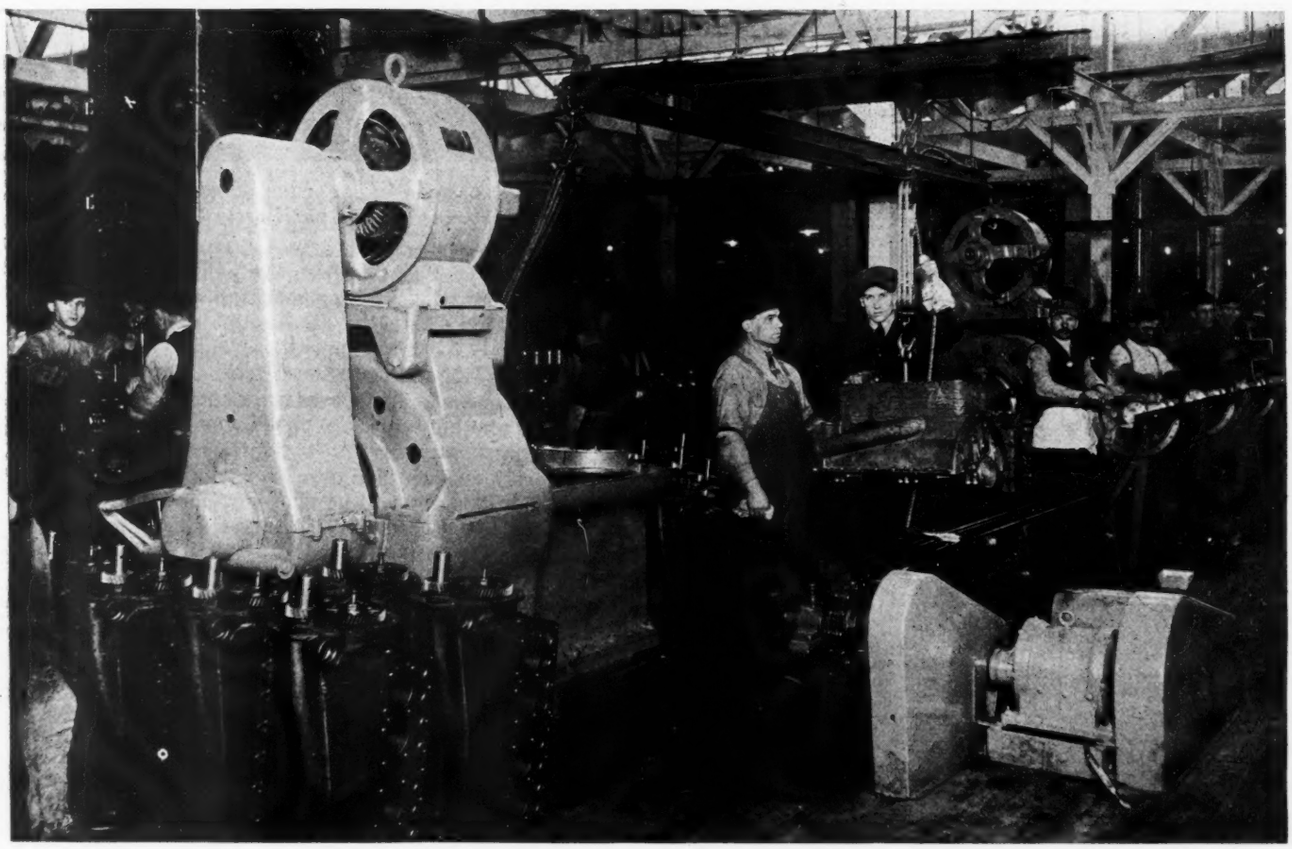


Fig. 5—Cylinder blocks leaving end of bearing adjustment chain and being carried by overhead conveyor to burning-in machine

ished blocks may be seen coming down the gravity conveyor and entering the assembly building at the start of the assembly conveying system. The assembly building is defined in Fig. 1 by the large brick pillars which divide it from the machine shop.

Immediately the blocks enter the first of the assembly lines they are passed through a large washing machine, electrically driven, in which they are washed in a strong boiling alkaline solution. The washing machine, which is partly shown in Fig. 2, is a product of G. S. Blackesley of Chicago, and is capable of handling forty of these blocks per hour. The boiling solution is thrown against the block by means of two large paddles, and the cylinder blocks leave the other side thoroughly cleansed of all grease and dirt. A few chips may remain, but the man who takes the cylinder blocks out at the other end of the washing machine conveyor has an air hose handy, with which they are blown away. This

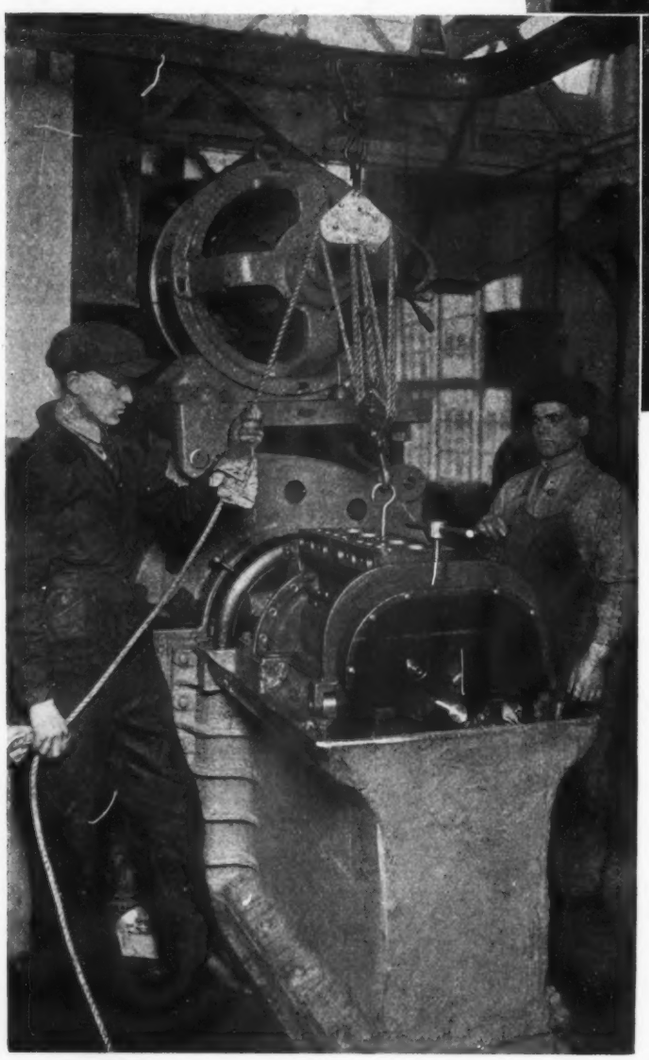


Fig. 6—Cylinder block on the bearing burning-in machine, where the crankshaft bearings are burnished before being finally adjusted

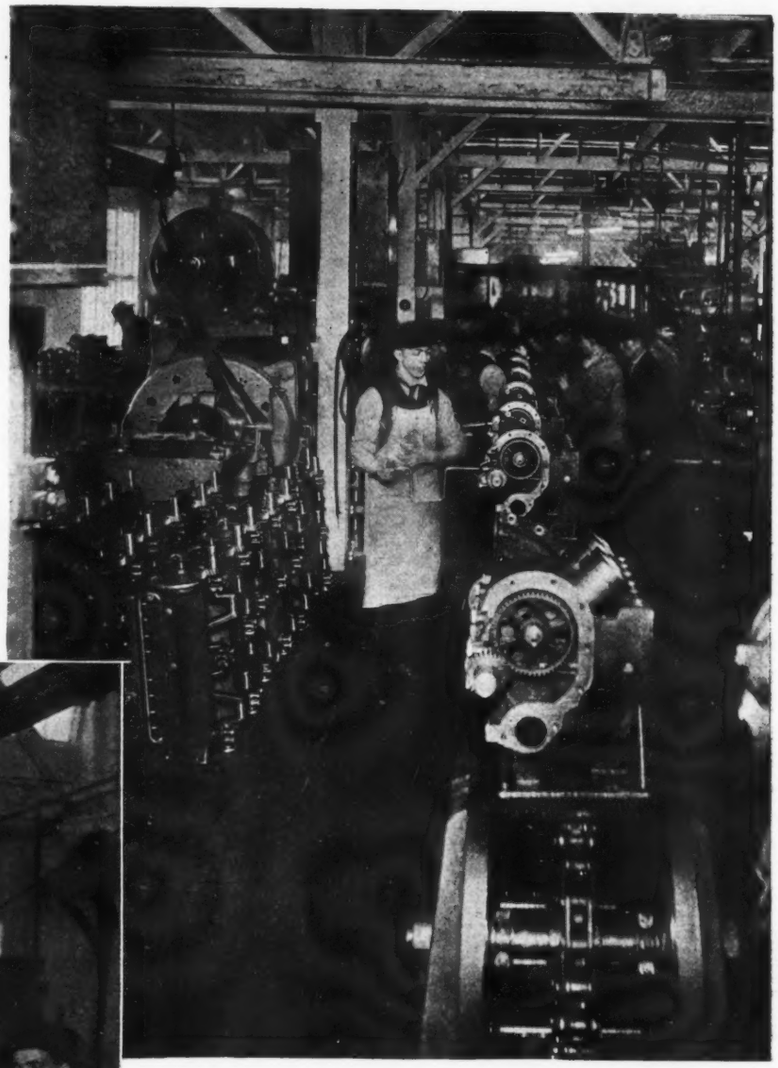


Fig. 7—The second length of the cylinder block assembly chain, showing pistons put loosely on top of block

is illustrated in Fig. 2, where the cylinder block, having passed through the washing machine and been inspected by the workman with the air hose at the end of the machine, is ready to start along the assembly chain, which is shown at the left of the illustration just begining its journey down the line. The closeness with which these blocks follow one another may be realized when we see, in Fig. 2, one block just starting on its journey on the chain, another block being carried over from the washing machine conveyor to the end of the chain by means of the overhead hoist, while the third block has already come out of the washing machine and is ready to be conveyed along the line.

The assembly chain for the cylinder block is in two parts. There is, first, a short chain which carries the block through the preliminary stages of assembly, including the fitting of the crankshaft. Then there is a break in the chain where the crankshaft is "belted in," and, finally the long length of chain which carries the block on to completion.

When the cylinder block is placed on the chain the first operation is to slip the camshaft into place. In the foreground of Fig. 3 is shown a rack which carries the camshafts, placed in a handy position to the operator, who reaches behind, picks up a camshaft and slips it into

Fig. 8—Note operators on both sides of track, one man slipping piston in and the other putting connecting-rod bearing caps in place

place. He then reaches to another rack in close proximity (not visible in the picture) and picks up a crankshaft and puts it into position.

As will be noted, the timing gears are already in place on the camshaft and the crankshaft. These gears were put on with an arbor press, located close behind the assembly chain, as indicated in the map. The first operator places the camshaft in position and meshes the camshaft timing gear properly with the crankshaft timing gear before the chain carries the block away from him. Whereupon the next operator tightens the main bearing cap screws with five shims under each bearing. After the blocks have traveled about 45 ft. on this first length of assembly chain and have been worked upon by about eight men they come off ready for the bearing "burnishing" machines. Fig. 4 shows most of this length of track. It also shows the arbor press in the background, where the timing gears are pressed onto the crankshaft before they are assembled. This will give an idea of the close proximity of this work to the assembly chain, the head of which can be seen in Fig. 4, and is readily apparent in Figs. 2 and 3.

An interesting feature in the assembly is the method used in burning in the bearings. The engines come off the end of the chain, as shown in Fig. 5, and are immediately lifted up by an overhead L-shaped carrier, shown in the illustration, and carried over to a burnishing machine. One of these, which is not yet in operation, but which will be shortly, is shown in the left foreground. The other can be seen in the background and is more clearly illustrated in Fig. 6. The step illustrated in Fig. 6 is simply a burnishing operation for the crankshaft, there being no pistons or connecting rods in the block. The machine is driven by an electric motor through a large reduction, since the torque necessary to start the crankshaft is very high. It requires about 30 sec. to burnish the bearings, and then the block is ready to go on its way to the next section of assembly chain, where the pistons and connecting rods are assembled.

The blocks are taken off the burnishing machine and slid immediately over to the next section of the conveyor chain for assembly, of which a general view is shown in Fig. 7. Here it will be noticed that men are working on both sides of the chain. This allows two operations to go on at the same time, one on one side and the other on the other side of the engine, and practically doubles the capacity of the conveyor chain.

An instance of this is very noticeable where the pistons and connecting rods are fitted and the caps slipped on. The pistons and connecting rods are slipped in through the top of the block which is lying on the right side of the track, as shown in Fig. 7, while the caps are put on the bottom of the rods, almost simultaneously, from the left side of the track. As the block is put on the beginning of the conveyor chain, shown in Fig. 7, a set of four pistons is picked up by an operator standing at the beginning of the track and laid upon the block. The block shown in the foreground of Fig 7 has these four pistons lying in place. The valves are then slipped in, and as the work progresses the rods, which have been fitted to the pistons, are put in, and the other parts of the engine in the usual order of engine assembly.

At the present time the rods and pistons are assembled on a separate bench alongside the conveyor chain. An operator will pick the set of four pistons off the block, take them over to the bench, fit the rods to them, come

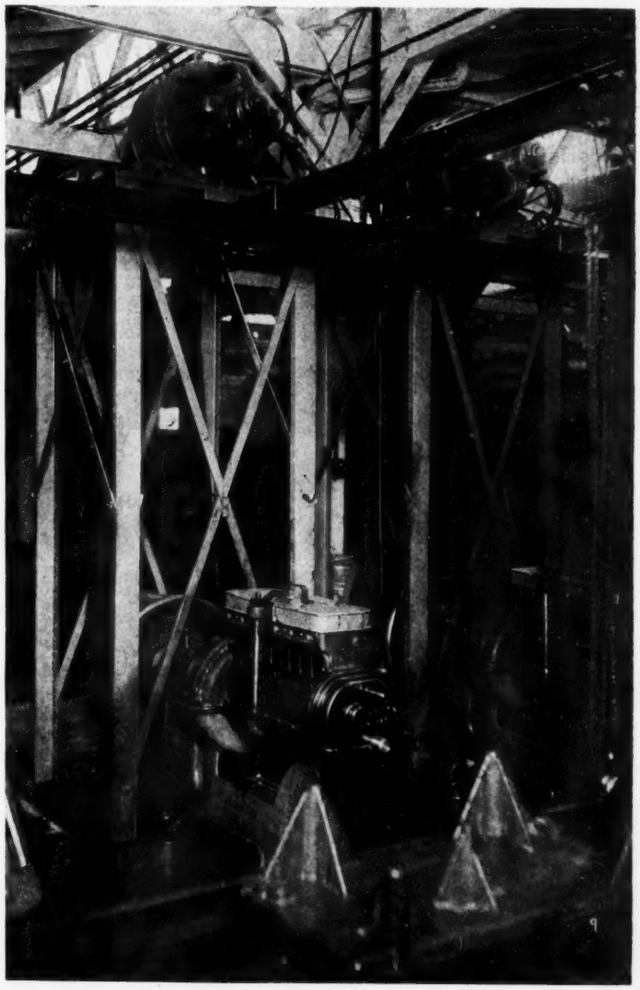


Fig. 9—Belting-in motor with sheet metal top and base formed like oil pan on belting-in machine. There are twelve of these machines to take care of the production

back to the block—which has traveled some distance during his absence—and fit them in place.

Fig. 8 shows the assembled pistons and rods lying on top of the engine blocks. One piston assembly has already been put in place at the left end of the block, while the second is just being fitted. The other two are lying on top of the block. An ingenious pincher-shaped device is used for clamping the rings, so that it is easy to slip the piston into place. This can also be seen in the illustration. As the pistons are slipped in, the operator on the other side of the chain puts the caps into place, inserting the necessary shims for a trial fit, and then taking out the shims necessary to get the engine to turn over properly.

Fig. 10—Sub-assembly of magneto. Note unassembled flywheels on racks and operators working along bench progressively

As the track travels along the operator follows this work himself until he has the bearings properly adjusted; that is, this small portion of the work is not exactly progressive, as the same man fits the bearings from beginning to end, so that he is posted as to the fit and does not leave the next man to make an unnecessary set of experiments to see how tightly the bearings fit before he goes on with the next step in the work. Similarly, one man will follow the connecting rod bearings down through the next belting-in process, traveling along with the chain until he has adjusted the bearing to a satisfactory fit. Fig. 9 shows this belting-in process.

At the present time twelve machines are being used to "belt-in" the engines. These machines have a table, formed exactly like a crankcase, and the engine is mounted directly upon it without the head in place, but with the pistons, valves, shafts and timing gears all completely assembled. In order to stop the oil from splashing out of the tops of the headless block, a sheet-metal head is clamped over the cylinder block. The engine is then given a thorough "belting-in," the length of the run depending on the necessities of each individual case to secure a proper work-in of the bearings. The twelve "belting-in" machines, however, are more than ample to take care of the present production of 300 per day. In

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Fig. 11—Cylinder blocks coming along chain ready to have the field plates with the field coils bolted upon them; after which they are ready for the magnetos

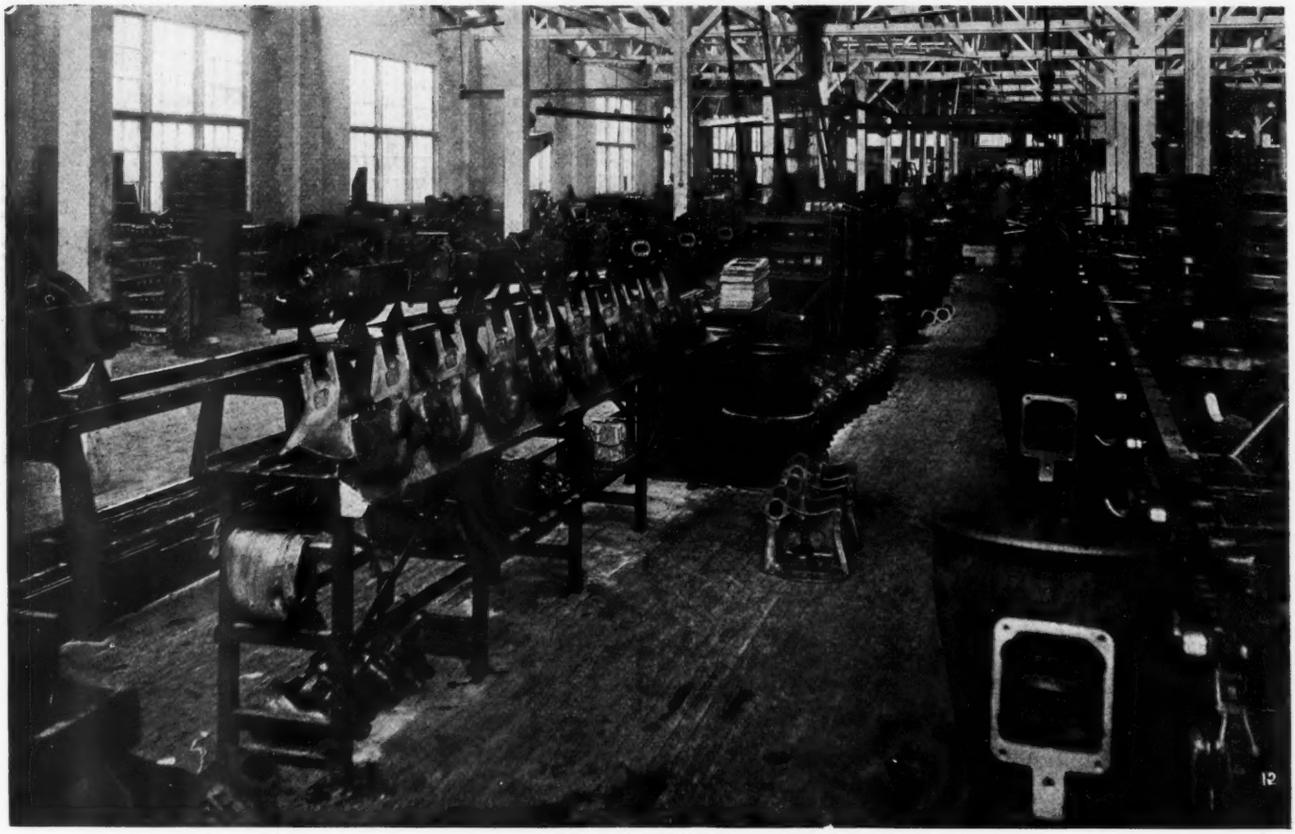


Fig. 12—View of cylinder block track with rack of timing gear housings in foreground

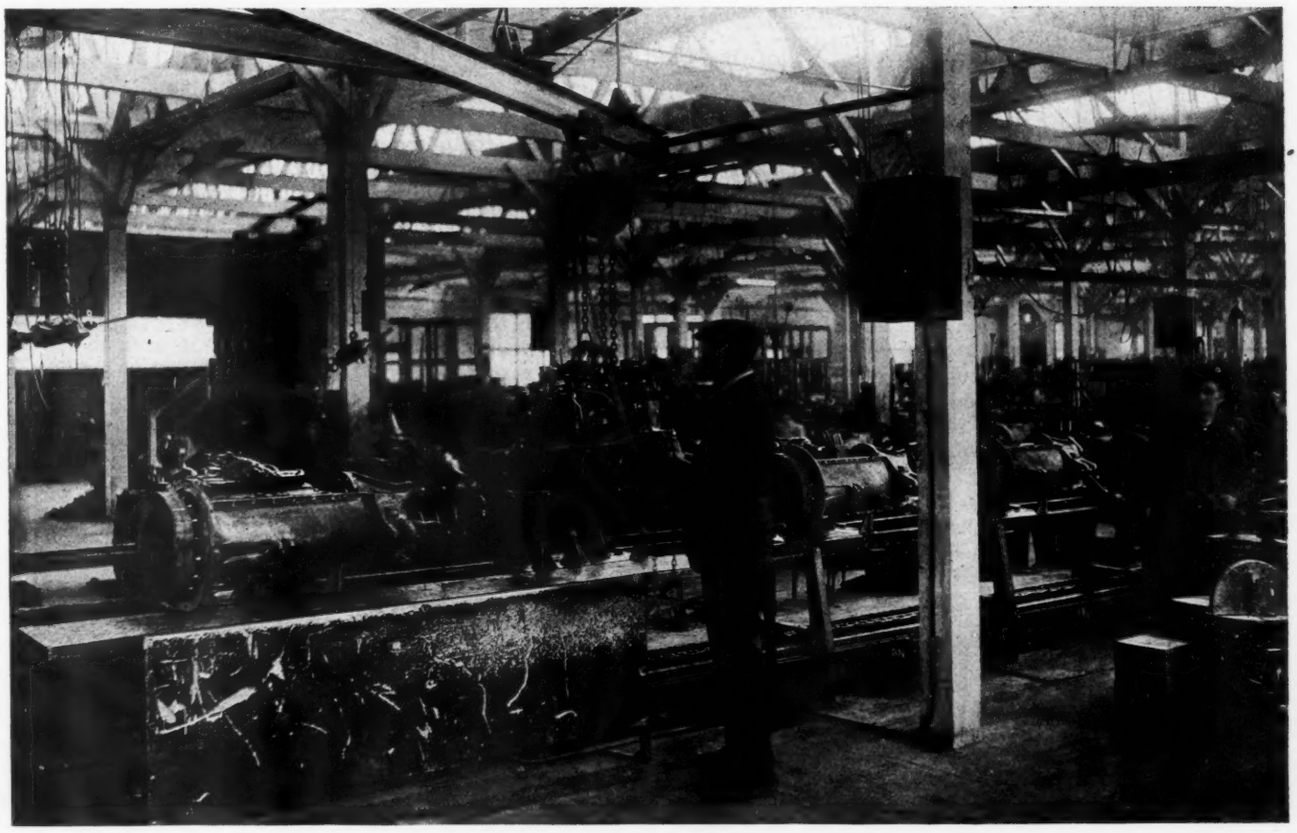


Fig. 13—Finished engine coming off end of engine assembly chain to be carried on overhead track to tractor assembly

This English truck loaned to the American army is one of many sent to Reconstruction Park for salvage

M. T. C. Salvage Park in France

PART II

An American War Factory in the Heart of France—3500 Employees—Built in 65 Days—Was 120 Miles Behind Front —Engine Department Overhauls 100 Engines Per Week —1000 Jobs Weekly Output—Manufactures New Parts

By W. F. Bradley*

THE statement that the motor salvage park gets out on an average 1000 jobs a week gives little information, for a job may vary from a slight body repair to making several thousand gears, this latter operation comprising the making of the dies, the forging of the blanks, and machining and heat treating. Ford commutators were not coming over in sufficient quantities at one time, so an order was put in for 5000 of these to be made. This constituted a job. A certain four-wheel-drive truck could not be kept supplied with steering arms; thus a job ticket went through for 8000 of these to be forged, machined and bushed. At the beginning of the present winter, hood covers were required, and 13,000 of these were produced in the park.

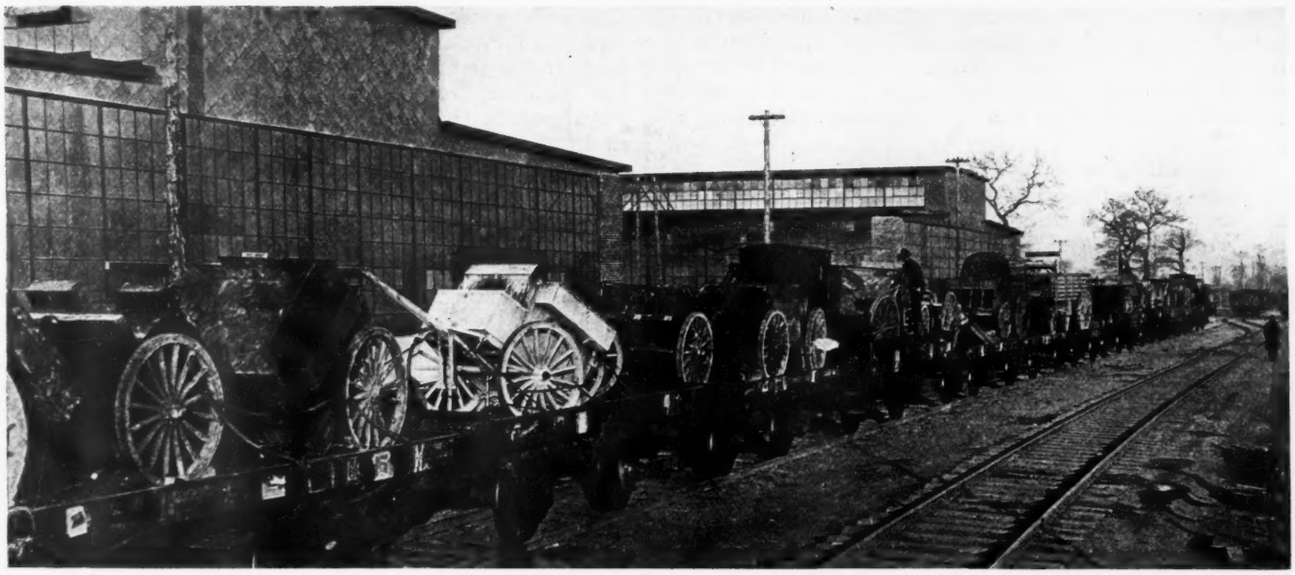
The following will serve to give some idea of the amount of work done in the salvage park. On the week previous to my visit, which was stated to be just a normal week, the staff had completed 78 trucks, which had gone in in all kinds of conditions and had gone out fit for service on the front. It had put 72 light cars into serviceable condition. It had rebuilt 43 motorcycles and 19 bicycles. It had turned out 146 animal-drawn vehicles and completed 363 miscellaneous jobs. These latter might have been anything from a special bushing to several thousands of some part produced on the automatics.

These jobs are really a manufacturing proposition and do not come under the heading of salvage. Work in this field begins with the reception of the wrecked material brought in direct by rail, and by complete train lots from the front. There are probably 5 or 6 miles of track inside the park, so that wrecked material can be handled as rapidly as it is brought in. The task is rendered difficult, however, by reason of the necessity of receiving wreckage while the ground is in course of preparation; a field with railroad tracks through it and no loading platforms does not constitute ideal conditions.

The Salvage Program

The material to be salvaged is either dumped on the ground or lifted out by steam crane and then sorted and passed on by experts. Motorcycles go into one sector; trucks, according to make, into another; touring cars are a separate lot, and Quartermaster horse-drawn vehicles have their own department. An automobile which has been abandoned at the front nearly always reaches the salvage park in skeleton condition. After it has been thrown on one side somebody discovers the need for a magneto. Another person removes the carbureter. A third takes out a few valves or valve caps. All the grease cups are stolen by the natives if they are not removed by the mechanics. Fan belts are never allowed to remain. In nine cases out of ten, when the park receives the automobile it can no longer be treated as a repair job, but has to be handled on salvage lines. Its engine is taken out and sent to the engine shop. There is no work in a factory at home that the salvage park cannot perform.

*EDITOR'S NOTE—*W. F. Bradley has studied motor transport during the war in France, Belgium and Italy and has been associated with this department of war since 1914. He assisted in the purchase of many automobiles and trucks for the A. E. F. in the summer of 1917 and personally superintended the overland delivery of many Fiat vehicles for our army. He made a minute investigation of the salvage park described in this article.



A trainload of Quartermaster horse-drawn vehicles at Motor Reconstruction Park

Stacks of gasoline drums at Motor Reconstruction Park. These drums were sent in for repair

German prisoners helping unload boxes at Motor Reconstruction Park

Crankshafts are being welded with very satisfactory results. Pistons are expanded, machined and fitted with new rings produced in the shops. When the chief of the engine shop gives his output as 90 to 108 a week, he means this number of motors completely overhauled as above.

The handling of a salvage park of this nature is full of complexity. In comparison, the salvaging of soldiers' clothing, shoes and rifles, of which much has been heard, is mere child's play. The greatest care is necessary in order to produce useful units out of the wreckage which is turned in. Unless there is skilled treatment, a park of this nature will merely accumulate big stocks of certain components and produce very few complete vehicles. The object aimed at is to get out of the wreckage the greatest number of complete vehicles and to have the smallest amount of dead stock. This is far from being a simple task, and although it is being handled in a very intelligent manner, stocks will accumulate.

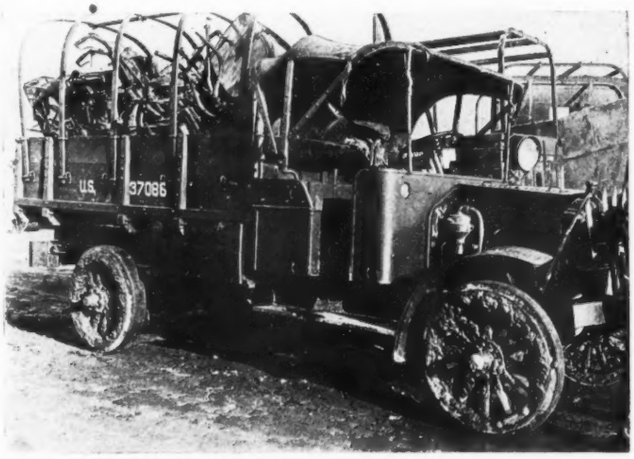
Very much depends on the decision of the officers who pass on the wreckage as it comes into the park. Should the automobile be in fairly good condition, it receives a job number to be rebuilt, in which case it goes out again with its own engine, its own gearset and its own rear axle. Such cases, however, are comparatively few. The next case may be a truck which has caught fire and has had one or more of its wheels destroyed and its frame member warped by heat. In such a case the engine, gearbox and rear axle are ticketed as separate jobs and sent to their respective shops for complete overhaul, after which they go into stock.

Certain parts on an automobile wear out or break and cannot be repaired. Springs come under this category. Therefore a complete spring manufacturing department has to be kept in operation, making for stock the types of springs most needed. Bronze bushings are in practically the same case, and also are in regular manufacture. All kinds of brass and aluminum castings are made in the park, but iron castings are obtained, whenever required, from a French foundry.

Automobile tires are treated in exactly the same way as in the big repair factories at home. After being mended in these shops the tires go into the stores for reissue in exactly the same way as new stock.

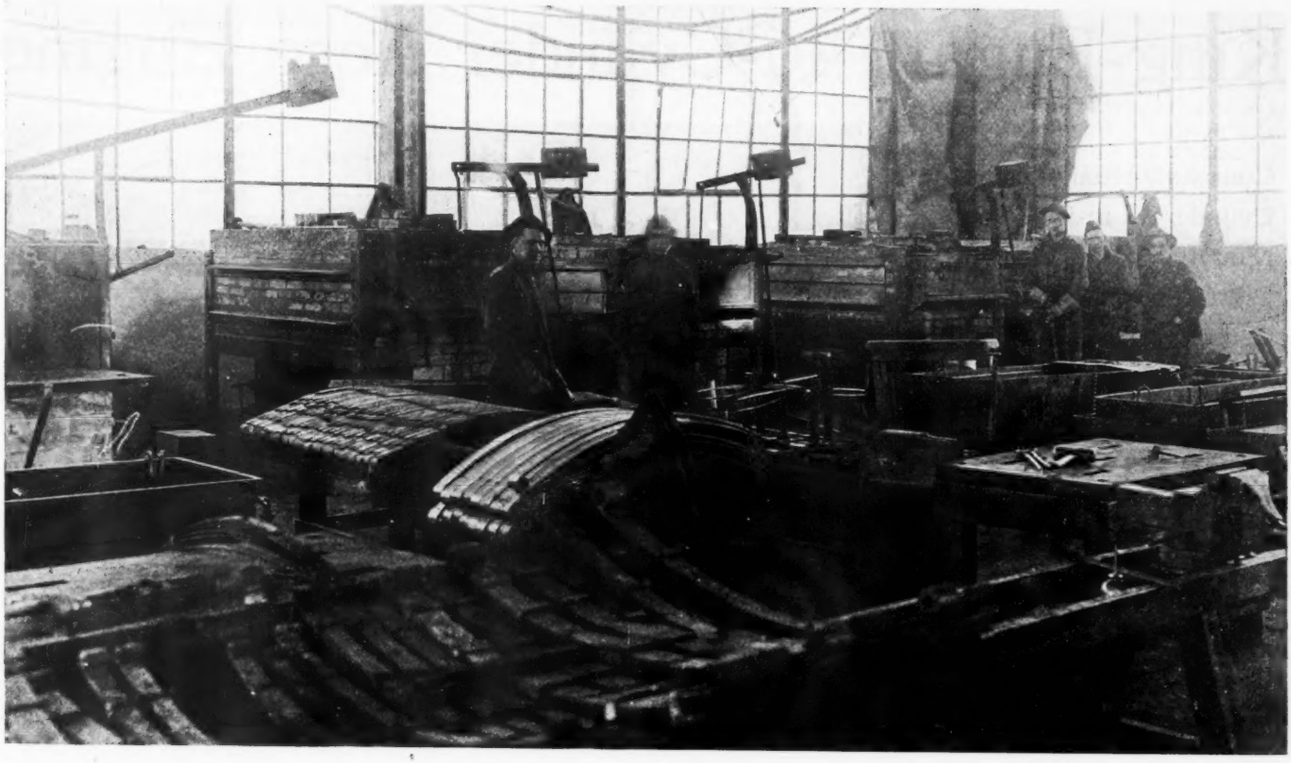
War Storage Depot

In addition to salvaging, the park is designed to act as one of the main automobile supply depots for the forces in the field. The stockroom, 300 by 400 ft., has its 120,000 sq. ft. of floor area divided into alleys, with one class of article in each, and the bins or lockers marked



A typical truckload of wrecked motorcycle parts

Part of the main stockroom at Motor Reconstruction Park



Spring-making department at Motor Reconstruction Park

A huge creeper type tractor and its German crew at Motor Reconstruction Park

according to make. The general arrangement is the same as that in the big automobile factories at home, but instead of parts for only one make, there are complete parts for 41 different makes always in stock ready to meet requisitions.

Running along the outside of one end of the main stockroom are car lines from which new goods are received. At the opposite end of the building are dispatching counters with huge boards suspended above them showing Colombey, Dijon, Paris, etc., and immediately outside another set of car lines for dispatching. Everything is up to date, including small electric freight cars for running about the stockroom.

When the salvage park was established there was neither light nor power in the neighborhood. The original intention was to erect a Diesel engine, and preliminary arrangements were made for this, but the supply of crude oil having failed, or its procurement having become difficult, a 1500-hp. steam turbine engine had to be decided on. While the foundations for this were being laid, fourteen G. E. gasoline-electric groups, developing 700 hp., were procured and installed in a temporary building. These engines provided all the light and power for the entire park.

Naturally the park has need of a considerable amount of local transportation. This is covered by 119 trucks, 15 touring cars, 25 motorcycles, 5 Holt tractors, and 7 Holt caterpillar trailers.

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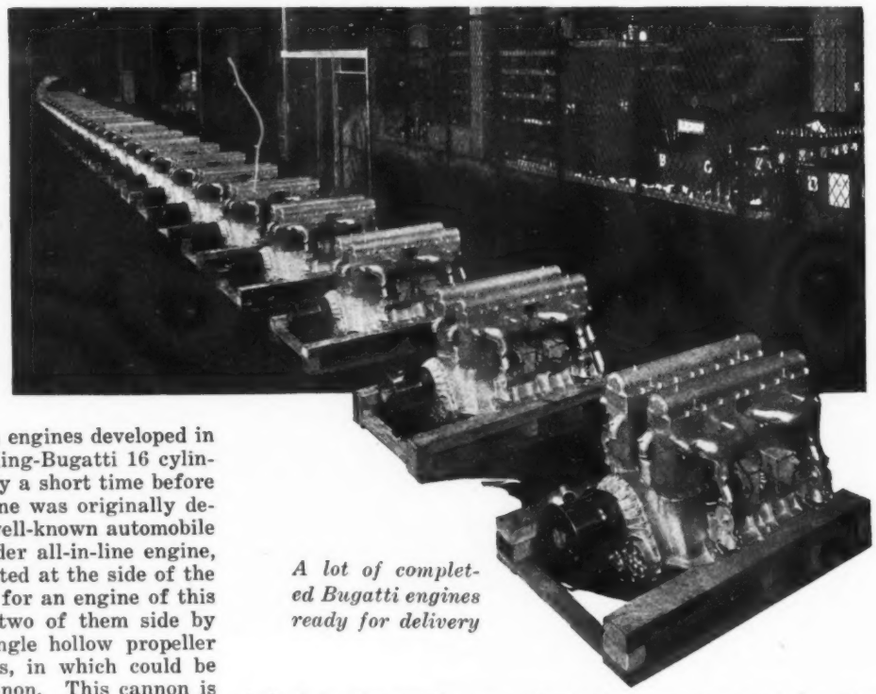
ACCORDING to French patent, No. 484,177, of E. Balzarini, a new method is disclosed for improving the action of sparking coils. In the method of construction usually adopted the secondary current often persists after the primary winding has been re-established by the interrupter, and the inverse current at the make suddenly damps out the secondary current that is still flowing, and then reverses its direction. This has several drawbacks, and in particular diminishes the efficiency of the apparatus.

The modification now proposed consists in providing two similar primary windings, put alternately into circuit by the interrupter, the connections being such that the successive primary currents magnetize the core of the sparking coil in opposite directions. Thus the electromotive force in the secondary circuit at the make agrees in direction with the existing flow of current. The result is that the current in the secondary circuit is rectified by a high-tension commutator. It would seem, though, that any advantages gained would be discounted by the reduction in efficiency due to the use of double primary coils.

King-Bugatti 16-Cylinder Aero Engine

Consists Virtually of Two 8-Cylinder All-in-Line Engines Mounted on a Common Crankcase and Geared to a Common Propeller Shaft—Designed to Permit 37-Mm. Cannon to Shoot Through Hollow Propeller Shaft



A lot of completed Bugatti engines ready for delivery

ONE of the most interesting aviation engines developed in connection with the war was the King-Bugatti 16 cylinder, which went into production only a short time before the signing of the armistice. This engine was originally developed in France by Ettore Bugatti, a well-known automobile designer. Bugatti first built an 8-cylinder all-in-line engine, with a geared-down propeller shaft, located at the side of the engine. There was found to be no need for an engine of this type, and so Bugatti decided to place two of them side by side, on a single crankcase, using a single hollow propeller shaft between the two sets of cylinders, in which could be mounted a standard French 37-mm. cannon. This cannon is loaded with buckshot, and its use had been proven very efficient by Guynemer, hence it had been decided to build planes on which this cannon could be mounted.

Bugatti then built a 16-cylinder experimental engine, which was tested in France on the block, and later was brought to this country together with the 8-cylinder model, the two being taken to Dayton, Ohio. The 16-cylinder engine broke down at once on the dynamometer test and developed serious defects, such as a crack between the valve seats in the cylinder castings and improper operation of the lubricating system. The engine was at once rebuilt by the French engineers who were sent along by Bugatti. In the meantime, it was realized that the engine was not a production job, and the defects mentioned, as well as structural weaknesses in the propeller shaft mounting, made it necessary to completely redesign it. This task was entrusted to Charles B. King.

The new design incorporated pressure lubrication, a ball-bearing mounting of the propeller shaft, a dry crankcase system, cylinder castings so made that the valve seats were properly cooled, water spaces in the casting cored out instead of being drilled out as in the French design, etc.

An engine to this design was built at the works of the Duesenberg Motors Corporation in Elizabeth, N. J. At the time the rebuilding of the French engine was completed, the first King-Bugatti engine was also ready for the test block. A one-hour full power test was made on the French engine, and horsepower curves were plotted, after which the engine was removed from the test block and put in storage as Government property. The King-Bugatti was then put on the test stand and given a very thorough test. Production of King-Bugatti engines was begun at the Duesenberg plant, and at the time the armistice was signed 40 engines had been officially tested and accepted by the Government.

With a cylinder bore of 110 mm. and stroke of 160 mm. (4.33 x 6.3 in.), the engine has a piston displacement of 1484.3 cu. in. The first engine accepted by the Government was put through a 50-hr. block test with a club. It ran through ten periods of 5 hr. each, consisting of ½ hour's running at 410 hp. at 2000 r.p.m., and 4½ hours' running at 369 hp. at 1886 r.p.m. The compression ratio used is 5:1.

The cylinders are of iron, cast in blocks of four. They are bolted to the crankcase without the use of a gasket. The water jacket is cast integral, except that the sides of the cylinder block below the inlet and exhaust ports are covered with a cast aluminum plate fastened by screws and packed with a gasket. The cylinders are cast with separate exhaust ports. One inlet port supplies two cylinders. Two outlet and one exhaust valves are used.

The entire combustion space is machined, with the exception of a very small recess near the inlet valve seat. The tops of the cylinder blocks are machined, making an oil-tight joint with the camshaft housing without the use of a gasket.

Provision is made for a liberal circulation of water in the neighborhood of the valve ports, seats and guides. There are two spark plugs per cylinder, which are located at the side of the combustion chamber in close proximity to the inlet valves, and are well cooled by the circulating water.

Crankcase

The crankcase and oil pan are of cast aluminum. The case is well ribbed. All bearings are supported from the upper part of the case, the bearing bushings being held in place by caps which extend almost the full width of the case. Each cap supports two bearings. They are all of cast aluminum, with the exception of the center bearing cap, which takes all the thrust of the crankshaft. This is a steel forging.

The oil pan has a central web running its entire length. This greatly assists in preventing the current of air caused by the revolving crankshafts from drawing up the oil which is constantly draining into the pan. There is also a cross web between each cylinder block which runs well up the sides of the oil pan. These cross webs have an opening at the bottom at their center, allowing the oil to drain to the ends of the pan on either side of the web running lengthwise. A breather is attached to the top of the crankcase near the front end between the cylinder blocks.

Provision is made at the rear end of the case for attaching a 37-mm. cannon, the barrel of the cannon projecting through the hollow propeller shaft.

The piston is of aluminum and has two ring grooves above the piston pin. Two ⅛-in. wide rings are placed in each of these grooves. The rings require a pressure of 10 to 12 lb.

applied on a diameter at right angles to the slot to bring the ends of the 30-deg. slot to within 0.010 in. of the closed position. The lower ring is beveled, being placed in the groove with the sharp edge down so that it acts as a wipe ring, forcing the oil on the down stroke into an oil groove cut just below the ring groove. The land between the bottom of the ring groove and the oil groove is 1/64 in. wide and it is 1/32 in. smaller in diameter than the land above this ring groove. This forms a free passage for the oil to the oil-collecting groove. Eight 3/32-in. holes are drilled around the piston, connecting the oil groove with the interior of the piston. These holes slope down at an angle of 60 deg. with the axis of the piston, carrying the oil wiped from the cylinder wall to the interior of the piston. A slot ⅛ in. wide by 1/16 in. deep is cut from the oil groove to the piston pin hole at both ends, thus lubricating these bearings. Two ½ in. wide by 1/32 in. deep oil distributing grooves are cut around the piston.

Piston Pin

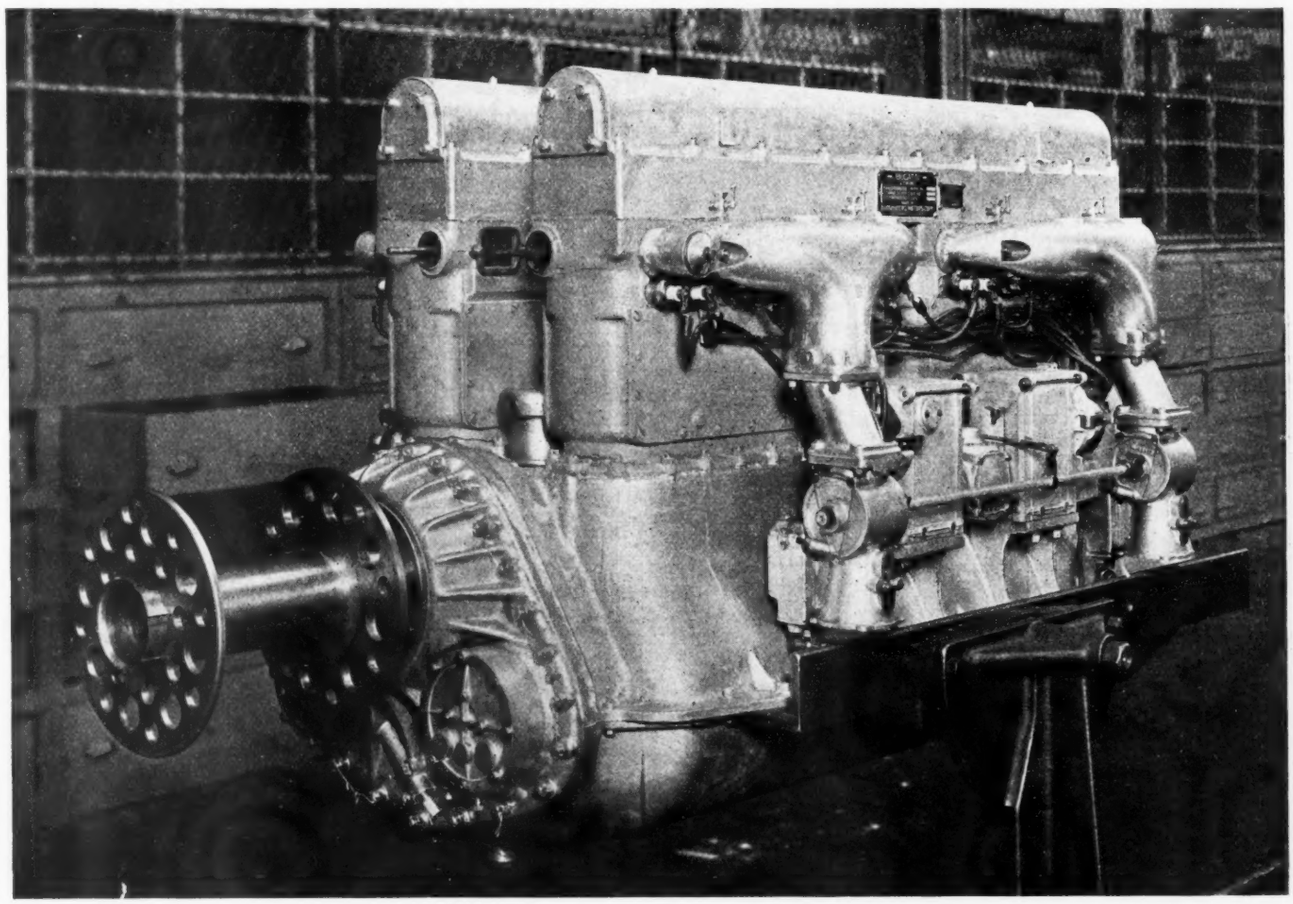
The piston pin floats in both the connecting-rod bushing and the piston. Bearing in the piston is directly on the aluminum. It is held from endwise motion by an aluminum plug pressed into each end. These plugs are drilled axially with a ⅜-in. hole which allows a certain amount of oil from the cylinder wall to enter the hollow piston pin. The ends of these plugs where they bear against the cylinder wall are turned to a spherical seat of a radius equal to the radius of the cylinder bore. In operation the piston pins turn more or less. Two ⅛-in. holes are drilled through the wall of the pin. These holes, when in a certain position, register with an oil groove in the connecting-rod bushing, allowing a certain amount of oil to enter the hollow piston pin, and when in the lower position allow the oil which is pocketed in the pin to run out onto the connecting-rod bearing.

The connecting rod is a steel forging machined all over. It is of H cross-section. The small end bearing is a bronze bushing pressed in position, having one straight oil groove 3/32 in. wide by 1/32 in. deep, running to within ¼ in. of the ends of the bushing. This groove is in communication with a 13/32-in. drilled hole in the connecting rod through a ⅛-in. hole. Oil collects in the pocket formed by the 13/32-in. hole and is led to the bearing through the ⅛-in. hole.

The big end of the connecting rod is fitted with a bronze bushing which is babbitt lined. This end is split at right angles to the rod on the center line of the bearing, the cap being held in position by two ⅜-in. chrome nickel steel bolts. The bushing is relieved at the parting line by five grooves, 3/16 in. wide, about ¾ in. long, 3/64 in. deep, cut on a 7/16-in. radius with a center on the parting line. The rod half of the bushing has no oil groove; the cap half has a circular oil groove entirely around it cut on the center line of the bushing and registering with the oil feed hole in the crankpin. This groove is ⅛ in. wide by 1/32 in. deep. The bushing in the cap is kept from turning by a dowel pin with an enlarged head. This head enters a countersunk hole in the cap, the small end entering the hole in the bushing when it is placed in position. This end is of such a length that it does not project through the bushing. The pin is thus locked in position and cannot drop out on the shaft.

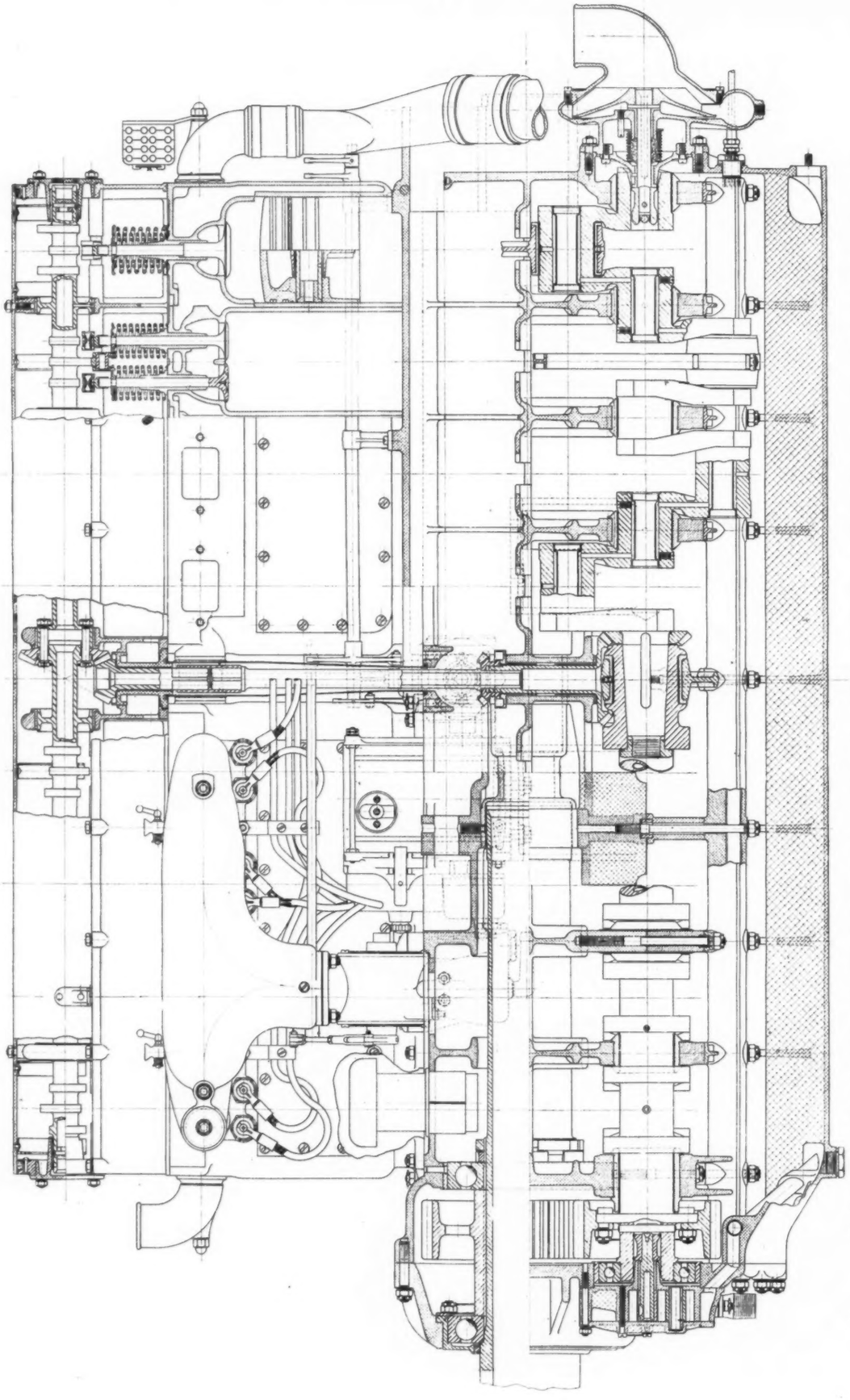
Crankshaft

The crankshaft is made in two pieces, connected at the center by a taper and key drawn up with a nut. Each section of the shaft forms a four-cylinder shaft with the throws all in one plane, the throws of the two sections being assembled at right angles. In assembling, the rear end of the front half is immersed in boiling water; the tapered end of the rear section, which is cold, is then slipped into position, and the parts are drawn together by the nut, using a long-handled wrench. The rear end of each complete shaft has clutch teeth cut on it for attaching a starter.



The 16-cylinder King-Bugatti engine, viewed from the propeller end

Bugatti 16-Cylinder Engine in Section



This engine has a bore of 110 and a stroke of 160 mm. The above sectioned elevation shows numerous details of construction

All end thrust coming on the shaft is taken by the center bearing, all other bearings having about 1/16 in. clearance at both ends. All bearings, including the connecting-rod bearings, with the exception of the center main bearing, are undercut. This results in a total shortening of the shaft of approximately 4 31/32 in. and in a considerable saving in weight.

The crankshaft main bearings are bronze bushings, babbitt lined. These bearings are not relieved at the parting line, and there are oil grooves only in the lower halves of all but the center bearing. These have a 3/32 in. wide by 1/32 in. deep circular oil groove entirely around them. This groove registers with the oil hole into the hollow crankshaft bearing. As this oil hole is drilled through both walls of the bearing on a diameter and as the oil groove in the bushing extends through 180 deg., there is aways a free passage for the oil from the bearing into the hollow crankshaft.

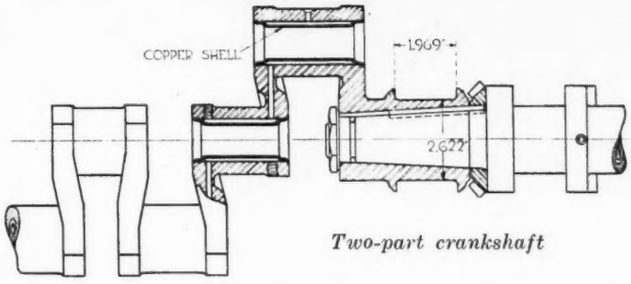
In assembling the completed crankshafts in the crankcase, they are placed in such relation to each other that if No. 8 throw left is on top dead center No. 8 throw right will be 45 deg. past bottom dead center. Both cranks turn clockwise viewed from the rear of the engine.

The propeller driving gears are bolted to the crankshaft with nine bolts equally spaced, the bolt holes being drilled in a certain relation to the gear teeth. This makes it possible to use the same gear on either shaft, with a maximum error in the setting of the shafts of 20 minutes.

Valves

The inlet and exhaust valves work in cast-iron guides pressed into the cylinders. Liberal water space is provided in the cylinder head in the neighborhood of these guides.

The exhaust valve stem is hollow from the head to within a short distance of the necked portion at the upper end. The hole is closed at the head end by a short, threaded plug screwed in below the surface of the valve, the recess then being filled level with the surface of the valve by welding. This closes the hole tightly and locks the plug in position. The lower end of the exhaust valve stem is of larger diameter than the upper end. Both the large and small diameters take a bearing in the valve guide. At the shoulder formed by the junction of the two sizes of stem three 3/32-in. holes are drilled at an angle of 30 deg. with the axis of the stem, sloping toward the head of the valve and connecting with the drilled hole in the stem. At the upper end of the stem just below the necked portion a 5/32-in. hole is drilled through



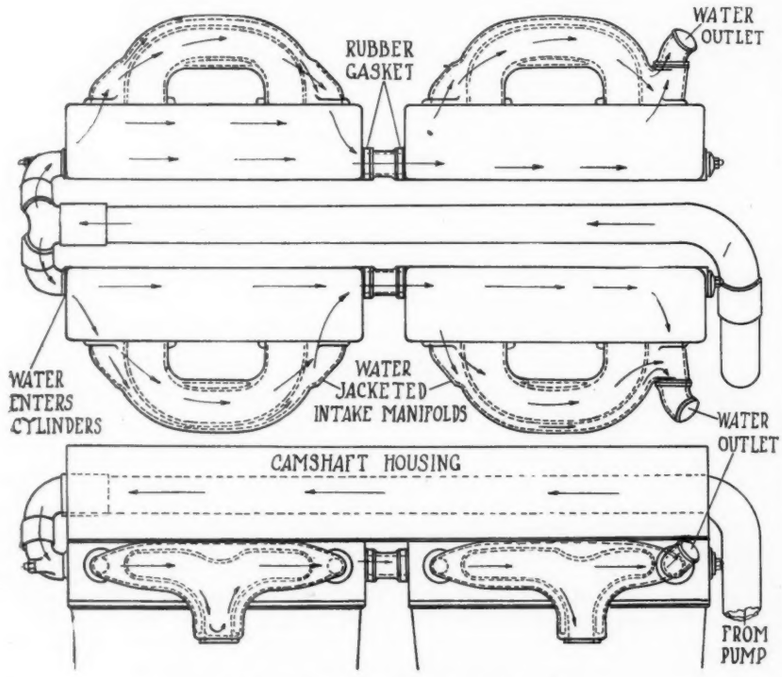
Two-part crankshaft

the wall of the stem. The movement of the valve up and down in the guide causes a pumping action, the transfer of air within the valve stem being thought to cool the steam to a certain extent. This drilling also lightens the valve.

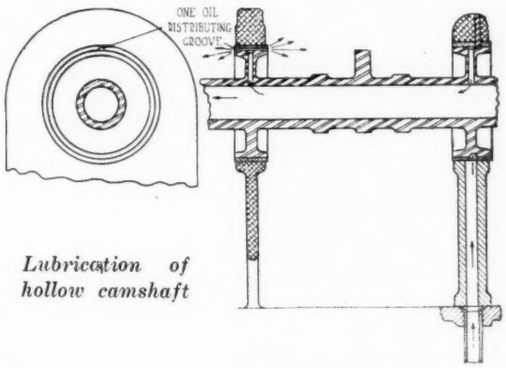
The valves are operated by an overhead camshaft through a rocker arm. These rocker arms are pivoted on steel shafts which are slid into drilled holes along both sides of the camshaft housing. There are four of these rods to each housing, each one-half the length of the housing. The ends of the rods butt together at the center, the outer ends being flush with the ends of the camshaft housing and covered by the end bearing support for the camshaft when this is bolted in position. The rods are thus prevented from moving lengthwise. They are a tight enough fit in the drilled hole in the camshaft housing so that there is no turning motion. The outer end of each rod is tapped for a wrench to be used in withdrawing the rods from the housing.

Each rocker arm operates one valve. The arms are forgings and the pivot bearing on the rod in the camshaft housing is not bushed. The cam operates on the large roller, which is of hardened steel, taking a bearing on the hardened steel pin. This pin is held in the rocker arm by spinning the metal of the arm around the beveled end of the pin. The small roller operates directly on a cap placed over the end of the valve stem. This roller is of hardened steel and takes a bearing on a hardened steel pin the ends of which are soft and spun over into a bevel at the outer edges of the hole in the rocker arm.

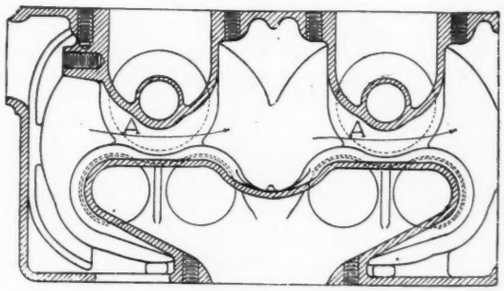
The end of the valve stem has a cap slipped over it, the upper end of the cap being hardened. The proper clearance, 0.015 in. for both the inlet and exhaust valves, is obtained by placing shims in the cap. Three different steel shims are used of 0.003 in., 0.005 in. and 0.010 in. thickness, the first



Illustrating direction of water flow



Lubrication of hollow camshaft



Cooling of the valves

being octagonal, the second hexagonal and the third round, so that the different thicknesses may easily be picked out by eye.

The upper valve spring retainers have a central tapered hole, the large end being on top. The valve stems are necked, and a tapered split collar is slipped into the necked portion of the stem, large end up. This taper is the same as that of the hole in the spring retainer. The pressure of the valve springs forces the retainer against the tapered collar, which is prevented from moving by the shoulder on the valve stem, thus locking the retainers into position.

Camshaft Drive

There are two overhead camshafts, each one running the full length of the two cylinder blocks. Each shaft is made of two separate shafts joined near the center by six bolts passing through flanges on the shaft. These bolts also hold the camshaft gear in position. Each complete shaft is carried in ten plain bearings in a removable camshaft housing. The two housings are of aluminum and each one is bolted directly to the top of the cylinder blocks without the use of a gasket by twenty ¼-in. studs.

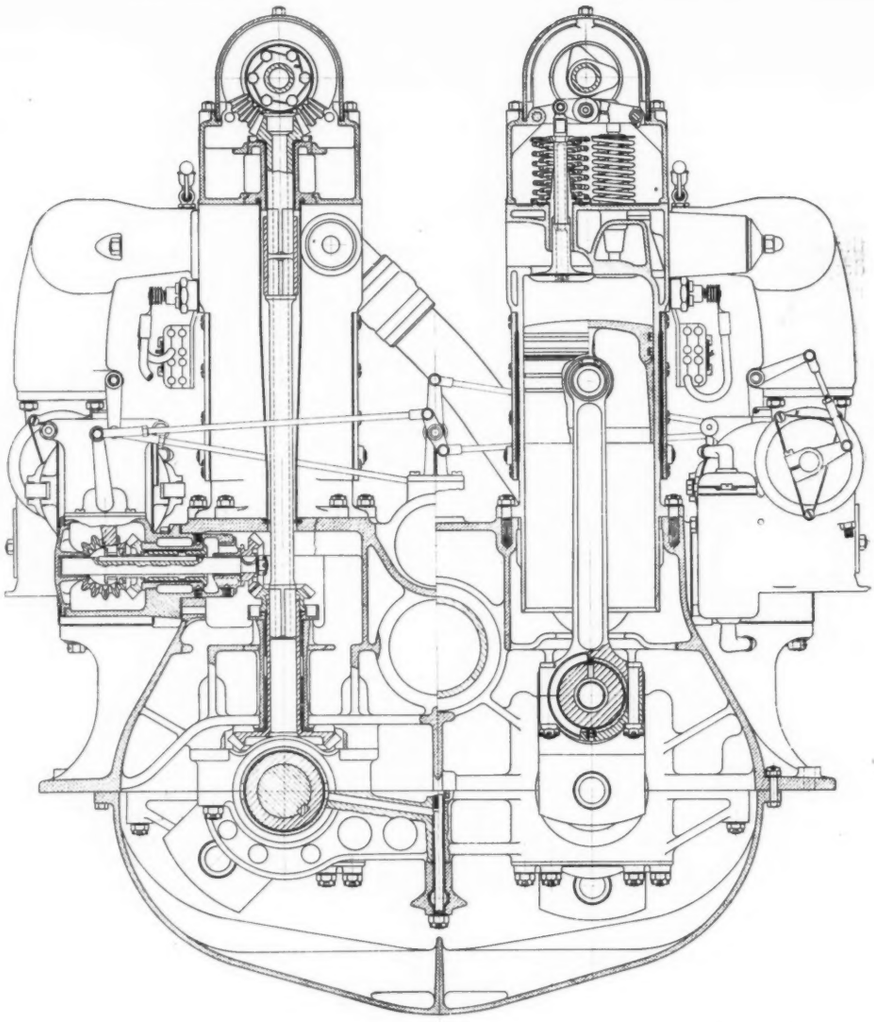
The first camshaft housings had a sheet aluminum cover, but a later housing is made entirely of cast aluminum with a cast aluminum cover plate at the side running the entire length of the housing.

Each camshaft is operated through a bevel gear driven by a vertical shaft between the two cylinder blocks, which in turn is driven by a bevel gear on the crankshaft. The gear on the crankshaft is pressed in position and in addition is held by a key. The thrust of this gear is taken by the crankshaft center bearing. This gear meshes with a bevel gear which drives the vertical shaft, the thrust of the gear being taken on a bronze, babbitt-lined bushing pressed into the aluminum crankcase. This gear has a long shank which acts as a bearing for the gear, and has a fine external thread cut at its upper end. This upper end has a square broached hole, the hole having a definite relation to a marked tooth of the gear. The bearing for the upper end of the shank of this gear is a bronze bushing, babbitt lined, pressed into the crankcase. The upper end of the bearing is cupped to form an oil well which catches the spray in the crankcase which is led to the bearing. The magneto driving shaft driving gear is screwed onto the thread at the upper end of the shank, the adjustment of the gear being obtained by means of the thread.

This gear has a square broached hole, the same size as the hole in the shank of the gear it is screwed to, and is locked in position by dropping the camshaft driving shaft into position, this shaft having a squared section at both ends, the lower end fitting into the square hole in the magneto driving shaft driving gear and the square hole of the shank of the camshaft driving shaft gear. The gear on the camshaft meshes with a gear having a long shank with a squared section at its lower end, the square being cut with a definite relation to a marked tooth on the gear. This gear takes a bearing in an aluminum, babbitt-lined bushing which is held in position in the camshaft housing by a large, flat-head screw.

This bushing also takes the thrust of the bevel gear. The upper end of the vertical camshaft driving shaft and the lower end of the camshaft driving gear are connected by a coupling consisting of a square piece of steel with a square broached hole fitting over these square ends.

The teeth of all the gears being marked for the meshing position, they may be easily assembled in the proper positions for correct timing. *(To be continued)*



Transverse section of engine, showing camshaft and magneto drive

French Tractor Results

ON a certain farm in the Seine-et-Oise Department of France (says *Le Genie Civil*) a State-owned Titan tractor of 20 hp. carried out part of the reaping at the agreed contract price of $6.75 per acre, this price including hire of tractor, driver, oil, grease, and twine. It cut 62.5 acres of winter wheat, 37.5 acres of spring wheat and 27.5 acres of oats, a total of 127.5 acres. The winter wheat, which was a very thick growth, was particularly difficult to reap. It was sometimes only possible to work on three, and even two sides, thus increasing the fuel consumption. The other expenses of the farmer were 80 cents per acre which, added to the $6.75 agreed price, makes $7.55 per acre. The work done per day was only 7½ acres.

On another farm a 20-hp. Titan tractor reaped a quarter of the crop—136 acres out of 544. The tractor operated a McCormick reaper of 7 ft. cutting-length. The ground being level in this case, it would have been possible to make the tractor drive a reaper-binder of 9.2 ft. cutting-length, or even two ordinary reaper-binders. Not counting binder twine, the cost of work with the tractor came out at $3.18 per acre, while animal traction only cost $3. This slight difference is more than compensated for by the increased speed of working.

The Engine of the Side Car Motorcycle

PART II

An Analysis of Features of Cycle Engine Construction in a Paper Presented to the Institution of Automobile Engineers by E. Caudwell

THE internal cam, which has been largely favored, while it has certain advantages in permitting the use of rather longer bearings with a more compact timing gear, has not much else to recommend it.

Fig. 3 shows the exhaust cam and rocker of a well known engine, and Fig. 4 the lift, velocity and acceleration curves, plotted for 3000 r.p.m. of the crankshaft. It will be noted that the lift curve is unsymmetrical, due to the displacement of the roller in relation to the center of the cam. The roller moves on an arc about the rocker center, and this causes it to approach the cam as the valve lifts and to recede as it closes. The velocity therefore rises to a higher value during the opening period. Most interest is attached to the acceleration curve. As the valve is opening this rises to 6000 ft. per second per second. Taking the weight of the moving parts at 0.7 lb., it requires a spring strength of 130 lb. to compel the valve to follow the cam.

Since such a spring is a practical impossibility for this size of engine, it follows that the valve jumps at this point and then lags behind the cam. As the valve is closing, the lift curve, instead of approaching the base line asymptotically, cuts across it, indicating such an extremely rapid change of velocity that the acceleration curve runs up toward infinity, approximating to a rectangular hyperbola, so that its final values cannot be plotted. While this effect is reduced by the elasticity of the parts and the lag of the valve, it is clear that the valve closes with a considerable amount of shock and noise, while it is worth noting that engines with internal cams have always been the worst offenders in breaking valves.

A constant acceleration cam is also shown. The spring strength required for this is 58 lb., and though the areas during opening and closing are not so large, there would be a considerable gain in efficiency, quiet running, and probably increased power at high speed, since the timing would be more accurate.

These diagrams also show why, when tuning up an engine for high speed work, the first thing to do is to enormously strengthen the valve springs.

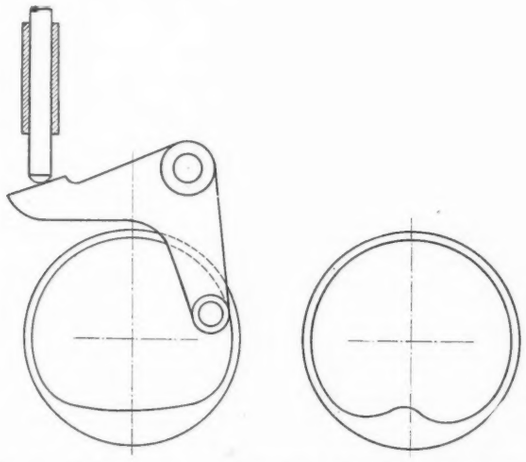


Fig. 3—Exhaust cam and rocker of well-known motorcycle engine

Tappets also have an extraordinarily short life, and after a few hundred miles running develop a large amount of side play. This is often aggravated by the offsetting of the valve from the center of the tappet, resulting in very heavy side loads, while the diameter of the tappet is always much too small, frequently being only 6 mm.

It should be noted that a flat twin engine and a four-cylinder engine both permit of good design of the valve gear; in the former case a camshaft can be mounted in the crankcase over the crankshaft with plenty of room for ball bearings, and a good width of timing wheel and cams.

The four-cylinder engine with its valve gear in front is also practically unrestricted, so that there are no difficulties in the way of bringing the valve gear for these types up to car standards.

Weights of Engines

The single-cylinder engine is the heaviest of any type for its power output. This is largely on account of the heavy flywheels required, especially when placed inside the crankcase. One popular engine weighs 68 lb., but the average for most other makes is 85 lb. The Vee twin-cylinder engines are somewhat better, the average weight being about 100 lb. for a one liter engine (61 cu. cm.).

No weights are available for the flat twin engine, but it should have a good power-weight ratio on account of its small crankcase and large and therefore light flywheel.

These engines all require an unnecessarily heavy transmission on account of the fluctuations in crank effort, and this should be borne in mind when judging an engine on the question of weight.

The four-cylinder engine is the lightest of all, and its even crank effort and adaptability to a high speed gearbox have a large effect in reducing the weight of the transmission. The four-cylinder Henderson engine is the largest in use to-day, having a piston displacement of 1170 c.c. Yet the complete power plant—engine, clutch and gearbox, with kick starter, magneto, carbureter and muffler—only weighs 128 lb.

The ratio of bore to stroke is a matter on which little originality has been shown. About a decade ago, when the A. C. U. fixed 500 c.c. as the limit in capacity for the 3½-hp.

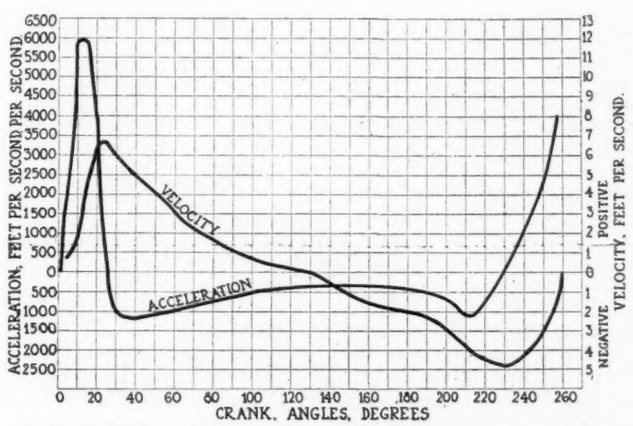


Fig. 4—Lift, velocity and acceleration curves for 3000 r.p.m. of the crankshaft

Four-Cylinder Henderson Engine

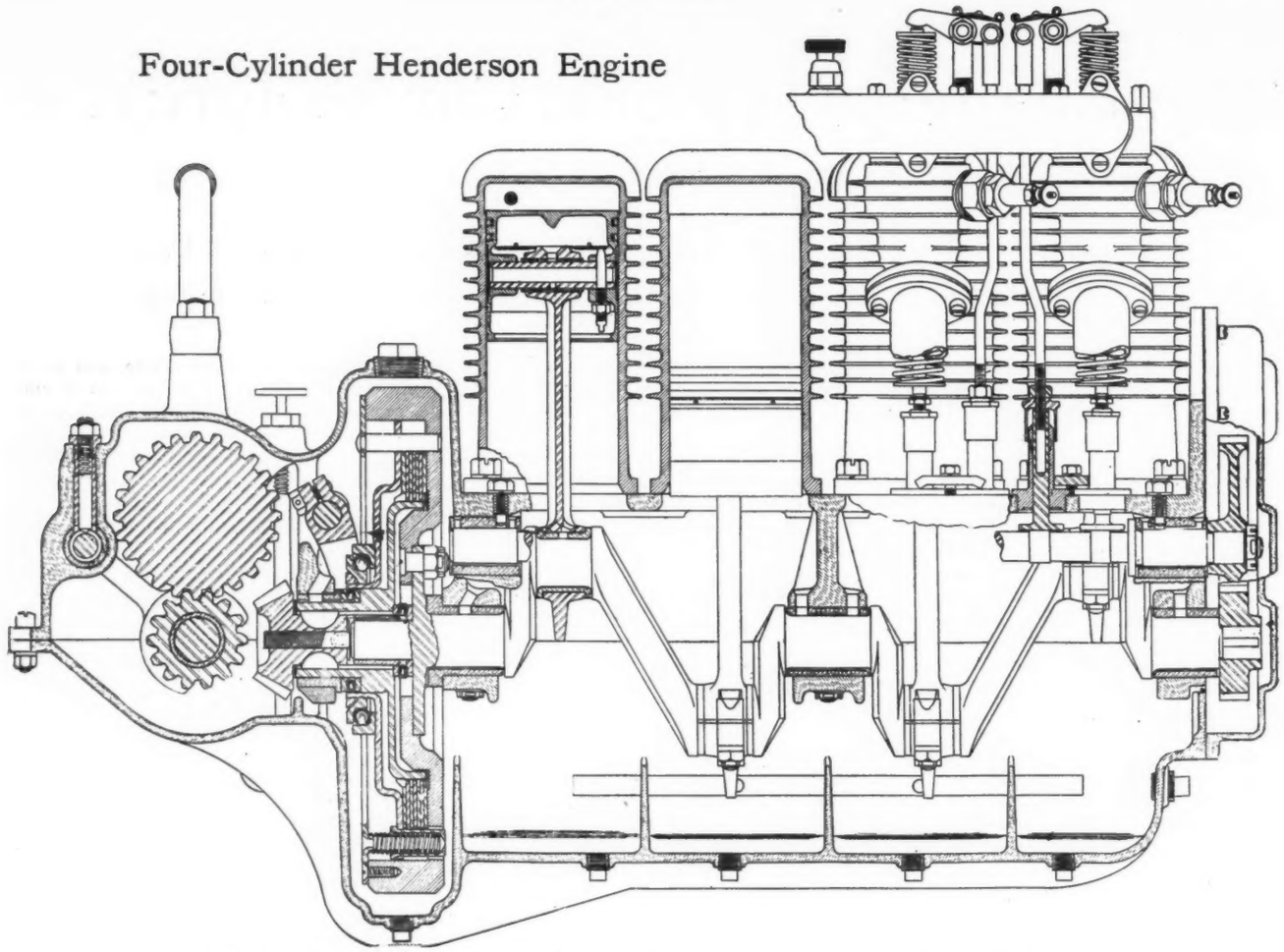


Fig. 5—Longitudinal section through Henderson engine, clutch and gearbox

class in races and competitions, one well known maker gained numerous successes with an engine 85 mm. bore by 88 mm. stroke. As a consequence this engine was treated with the sincerest form of flattery, namely, imitation, and many people since then seem to have regarded these dimensions as a sort of standard. Aside from one or two notable exceptions, there is no sign that any effort has been made to improve design by an alteration in the stroke-bore ratio, although with car engines average practice has settled down to the employment of a stroke 1.5 times the bore. Theoretically, neither balance nor crank effort is affected by the stroke, as the unbalanced force depends entirely on the point in the stroke at which the connecting-rod and crank are at right angles, *i. e.*, the ratio of connecting-rod length to stroke. For any given piston swept volume the crank effort and torque are also both independent of the stroke, as may be seen by an inspection of the fundamental horsepower formula P.L.A.N/33,000, which shows that for any given speed of revolution and any given mean effective pressure, the horsepower developed depends on L $\times$ A; in other words, the volume of the cylinder, so that if this is a constant, the power output must always be the same, and cannot be affected by the ratio of L to A.

It is often stated that a long stroke engine pulls better than a short stroke engine, but other conditions being equal this idea is a fallacy, because the average crank effort or torque is a function of the horsepower, being in inch-lb. for a four-stroke engine 63,025 times the horsepower divided by the revolutions per minute. So we see that the torque also is constant for any given volume of piston displacement, and is independent of the length of stroke and area of the piston so long as they produce the constant volume.

However, a lengthened stroke has a good effect in smoothing out the crank effort curve, as a small reduction in the cylinder diameter means a considerable increase in the stroke without a proportionate decrease in the weight of the reciprocating parts. Since the acceleration is proportionate to the stroke, we get a larger relative inertia force, which has the effect of reducing the peaks on the crank effort diagram, and therefore the ratio of the mean effort to the maximum variations. As it is generally convenient to employ a relatively shorter connecting-rod on a long stroke engine, this increases the aforementioned effect, since, as the ratio of connecting-rod length to stroke is decreased, the inertia forces become larger during the first and smaller during the second portion of the stroke. A longer stroke also gives a larger wall area for cooling surface. Further, for a limited width of engine, a decrease in the cylinder diameter is distinctly advantageous to other aspects of the design, allowing more space for adequate sizes of the valve operating mechanism.

In order to show that it is possible to build a power unit complying in a large measure with the conditions laid down at the commencement of this paper, Figs. 7 and 8 give longitudinal and cross sections of the 7-hp. F. N. engine. The bore and stroke are 52 mm. and 88 mm. respectively, and an inspection of the drawings will show that the engine contains all the usual features of a light car engine with the same relative proportions. The general layout of the machine is also on car lines, a flywheel, a clutch, a three-speed gearbox, and a final drive by shaft and bevel being employed. The crankshaft is of the two bearing variety with ball bearings, and there are two camshafts on opposite sides of the cylinders, which are T-headed. The magneto is of the usual car type with the distributor incorporated. The wheelbase of the machine is not excessive, but if the magneto had been placed at the side of the engine it could easily have been made 5 in. shorter, thus bringing it down to the average 6-hp. Vee twin-cylinder engine, namely, 56 in.

The lubrication system, which is also worthy of mention,

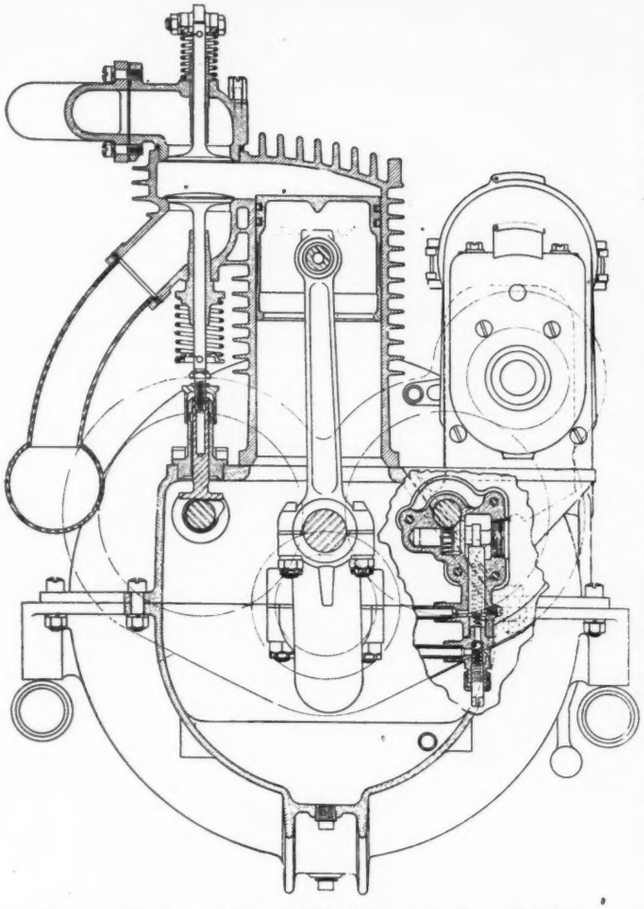


Fig. 6—Cross section of Henderson engine, showing lubrication features

consists of a special type of gear pump driven from the front end of the inlet camshaft; it draws oil from the sump and delivers it to troughs under the connecting-rods; these troughs are pressed in one with the filter plate, and the surplus oil runs through to be used over again.

As an indication of the extreme care which has been used in the construction of this engine, it should be noted that wherever studs have been employed on the crankcase they are not screwed into the aluminum, but into large steel bushes which are screwed in and pinned to prevent them from rotating.

Figs. 5 and 6 show the four-cylinder Henderson power plant. This represents another type of design, as the engine, clutch and gearbox are built as a single unit, and the drive is taken from the end of a cross shaft by a single roller chain to the rear wheel. The bore and stroke of the engine are 2¾ in. and 3 in. (63.8 mm. and 76 mm.) respectively, which give 1170 c.c. cylinder capacity. An L-head cylinder is used with the exhaust at the side and an overhead inlet valve operated by a rocker and push rod. Lubrication is automatic by means of a pump, and plain bearings are used throughout.

It will be noted that this engine also closely follows car practice and all its parts are of ample proportions and straightforward design.

As a further proof that a four-cylinder engine is not unduly long, it should be mentioned that although 28 in. by 3 in. wheels are used, the wheelbase is only 59 in.

Summary

To sum up the conclusions arrived at, we see that our requirements are fulfilled in the largest measure, and about equally, by the flat twin and four-cylinder engines. The flat twin engine has certain advantages in the way of fewer working parts, but, as generally placed, the cooling of the back cylinder is very inefficient and the cylinder is also inaccessible; in fact it cannot be removed without taking the engine out of the frame. It is noteworthy that at present there are no air-cooled flat twins in use of over 750 c.c. cylinder capacity. There is no reason, however, why below this size the engine cannot be placed transversely across the frame as has already been done by one maker, though the engine in this case is very much smaller. While a fairly large engine would certainly present a difficulty for solo use when placed in this manner, for the side-car machine there are no objections and many advantages, as it solves the cooling difficulty and also the question of accessibility; then, too, the crankshaft is in the right position for employing a proper car type of clutch and gearbox with final drive by a shaft. In order to keep the engine short, it is necessary for the stroke to be less than the bore, and as a 750 c.c. flat twin engine can easily be made less than 20 in. overall, it will go in the width of a side-car machine, many of which are 21 in. wide over the footboards. In larger sizes the overall dimensions of the engine begin to present difficulties, and we then come into the sphere of the four-cylinder engine. The even crank effort of this type is of great importance to the comfort of the rider and also in permitting the use of a light and durable transmission system, which also follows naturally from the disposition of the engine in the frame. The engine is also very adaptable to correct frame design, as it can easily be carried by a duplex tubular construction or a channel or pressed cradle when they develop.

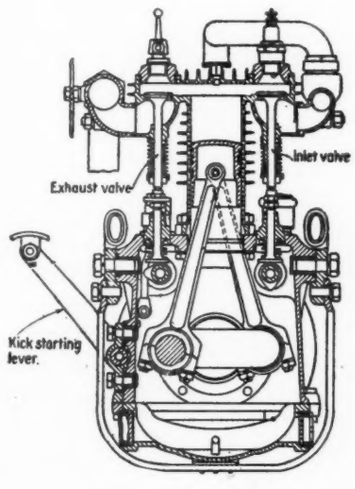


Fig. 7—Cross section of F N engine

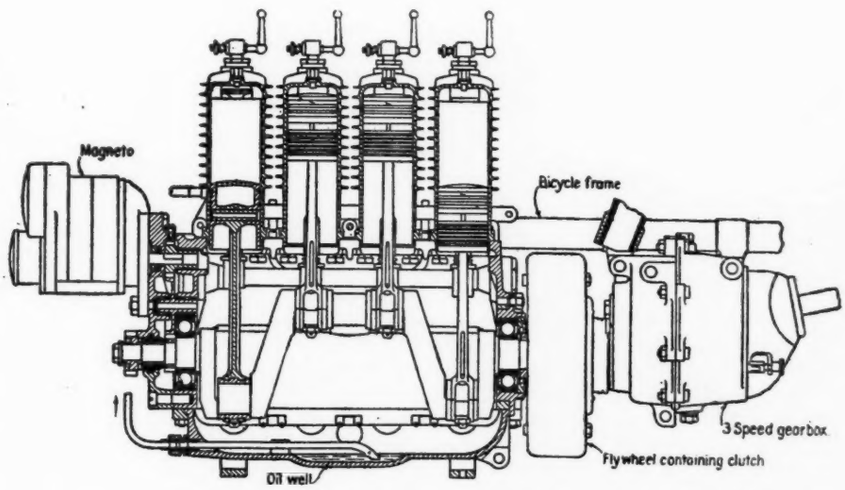


Fig. 8—Section of F N four-cylinder engine, with two-bearing crankshaft

Determining Correct Location of Brake Levers

Brakes Generally Not to Blame for Pedal Motion Due to Torque and Spring Action

By Walter C. Baker*

BECAUSE manufacturers using brakes which have proven entirely satisfactory in times past have altered their design from one using a torque member to one employing the Hotchkiss drive, and have experienced trouble in braking action, blaming it on the brakes, it has been necessary to devise some means of demonstrating that the trouble actually was not in the brakes themselves but in the manner in which these brakes were hitched up. Not only has this trouble occurred when the change was made to the Hotchkiss drive, but when the spring in this case was moved from a position above the axle to one below, many times causing engineers to say the brakes were inefficient.

In the discussion which follows I will attempt to show what most generally causes the trouble in braking action, and how it may be remedied by simply changing the rods and their locations; and it is believed that the analysis of braking action will be of great interest to all engineers connected with the design and production of automobiles.

In the design of motor vehicles employing what is known as the Hotchkiss drive, both of the passenger and commercial type, engineers have, in many cases, either failed to consider rods and levers, and braking action, or they have considered them insufficiently or incorrectly. The result has been that in a great many cases the brakes have either been inadequate or too severe. Almost universally is it true that, while at some one point and in one direction, the brakes may operate perfectly, yet at most other points or in the opposite direction the braking action is very poor.

Brake Rod Gage

Many annoying features characterize the brake that is incorrectly hitched up, in addition to the danger that always exists while driving. In all cases redesigning the brake rods and levers correctly will eliminate these disagreeable features, and to enable one to locate these centers correctly, I have designed and had constructed a brake rod gage.

It is not commonly known that somewhere in or about the rear axle there exists a transverse axis about which all torque action of the rear axle takes place. When a torque member is used, this axis is usually forced to coincide with the center of the rear wheels and axle.

When no torque member is used, as is the case with the Hotchkiss drive, this torque axis lies outside the axis of the rear wheels, and for ideal action of the brakes, the rear brake rod center should lie on this transverse torque axis, while the front brake rod center should be placed at a point which most closely approximates the center of the curve through which this torque axis moves, relative to the frame, when the car is in various positions above the axle, due to load and road conditions.

To correctly locate these points by graphical means or calculation with the information we have at present is an impossible task. They are more nearly located by tests on the car while in action, and to make such tests more productive of correct results a brake rod gage of some sort should be used.

The brake rod gage I have been using consists of several interchangeable rods, of various lengths, graduated every inch, and operating through a dial gage which indicates any lengthening or shortening of the rods, when placed by means of convenient attachments in the position of the brake rods themselves.

Action of Gage

The cause and effect of the elongation or shortening of the rods is explained in the discussion which follows.

Let us denote the torque axis by *T*. This is the axis

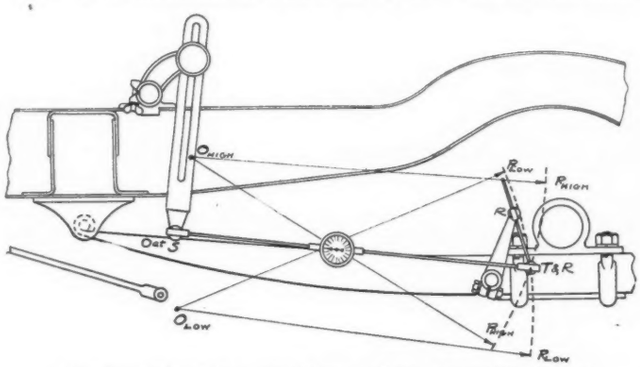


Fig. 1—Indicating conditions where O and S do not coincide

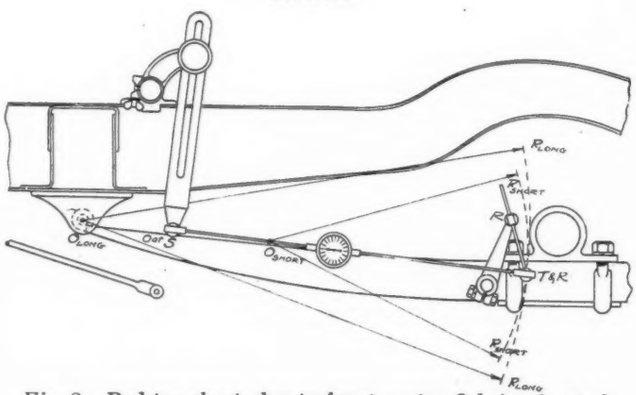


Fig. 2—Rod too short, due to front center O being located behind spring axis, or too long, due to its being located in front of S

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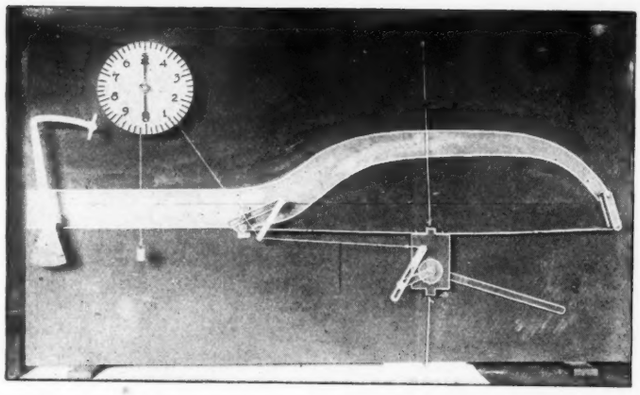

Fig. 3—View of demonstration apparatus used by Mr. Baker at Cleveland to show principles of brake layout gage

about which all torque action takes place while it in itself remains stationary, as referred to rear axle. It is plain then, that if the rear brake rod center were fixed on this axis, as far as torque is concerned, there would be practically no action of the brakes themselves due to the fact that the point of application of braking force is nearly stationary.

Let us assume, however, that the rear brake rod center is not correctly placed, and that it lies outside the torque axis on some axis such as *R*, then there must be some movement of *R* and *T* when torque action takes place.

Suppose we are looking at the car from the left-hand side, with the car traveling forward, the rear brake rod center *R* will move in a counterclockwise direction when the brakes are applied. If the rear brake rod center *R* happens to be above the torque axis *T*, such motion will tend to shorten the distance between *R* and the front brake rod center *O*. If the rear center *R* is below the torque axis *T*, the distance between *R* and front rod center *O* will tend to be greater. But since *R* and *O* are rigidly connected by a rod, *O* is forced to move with *R*, and consequently moves forward or backward, depending on the relative position of the rear rod center *R* with reference to the torque axis *T*. Of course, whatever tendency to shorten or lengthen the pull rod there may be when the car travels forward is reversed when the car travels backward and brakes applied.

With the brake rod moving forward and backward like this, one of two things must take place. Either there is a corresponding movement of the brake pedal and hand lever, multiplied by the leverage ratio, or, the brake levers of the rear axle are being operated upon independent of any voluntary action of the driver. Very often in cases of extreme movement of the rod, motion of the car in one direction automatically applies the brakes, or at least makes them grab severely, whereas, motion in the reverse direction makes it almost impossible to apply the brakes, due to the pedal in its extremes being in contact with the floorboard, thus limiting the radius action.

When the rear brake rod center *R* lies either in front of or behind the torque axis *T* on a line from the front rod center *O* to *T*, the action due to torque is usually very good, because what motion there may be is mostly up and down, which does not materially change the distance between the rear and front brake rod centers. This motion would, of course, increase as the distance of the rear center *R* from the torque axis increased, and when this became very great the change in the distance between *R* and the front center *O* would be considerable.

It is plain, then, that the only point at which there would be practically no motion of the rear axle is at the torque axis *T*, and a point on this axis is the ideal location of the brake rod center *R*.

In order to locate the torque axis *T*, let us employ the brake rod gage. The gage may be mounted either vertically or horizontally. It is shown here mounted horizontally. After the gage is mounted, a torque effort is exerted on the axle by some means. In this case, to show the action clearly, I have attached a rod to what would correspond to the axle housing, and by displacing this rod a torque effort is exerted sufficient for our purposes.

With the front center *O* of the gage rod fixed, any movement on the part of the rear center will be shown on the dial indicator, until adjustments are made which will so place this point that extreme movement in torque will have same indicator readings.

With this much having been done with the gage horizontal, it is then placed in a vertical position with the rear center still at the point just found. The locating process is then repeated. In the first case the rear brake rod center was confined to a horizontal plane containing the torque axis *T*, and in the second case, while not moving out of this horizontal plane, it is further confined to a vertical plane containing *T*. The rear center is thus forced to lie at the intersection of these two planes, or on the torque axis *T*.

We have been determining the best position for the rear brake rod center. Very often it is not possible to actually reach this point, due to the obstruction of other parts. When such is the case, the next best thing is to place it as near the actual torque center as possible and in a line with the torque center and the correct position for the front brake rod center *O* with normal load on springs. In order to do this the spring axis (*S*) must first be located, before which we must consider the action of the springs.

Car Action Due to Load and Road Conditions

When the car assumes various positions above the axle due to load and road conditions, it deflects or flattens the springs, whichever the case may be, and as they deflect or flatten the distance from the front eye to the spring seat shortens or lengthens respectively.

Since the axis of the front spring eye is held rigidly in position as regards the frame, the axle and all points on the axle member describe curves relative to the frame when successive positions are assumed on the frame above the axle. This curve that any one point describes is not an arc of a circle, because of the lengthening effect of the

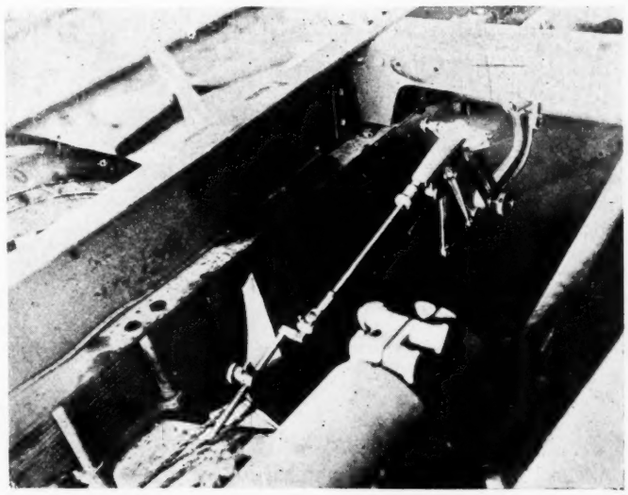

Fig. 4—Brake layout gage mounted on Class B truck

spring as it flattens. The curve is one which resembles an epicycloid, but for convenience in explanation the real curve has been exaggerated as shown here by the black line.

Since any point on the torque axis also moves in this curve, let us assume that this black line indicates the real path of the torque axis *T*. With the rear center of the brake rod *R* on the torque axis *T*, it is ideal for the front end to be at the center of a circle which most nearly approximates the curve described by *T*. This will maintain very nearly a uniform distance between the torque axis *T* and the front center *O*, and there will be practically no effort exerted to move the pedal or operate the brakes, independent of voluntary action of the driver.

If, however, the front brake rod center *O* does not lie on the spring axis *S*, we have a condition similar to the one shown in Fig. 1. Let us assume that under normal load the condition is at *T*. With the front center at *O* instead of *S*, the front center *O* will be forced to move in a circle about the countershaft a distance equal to the difference at any given position between the arc described by the torque axis and the circular arc described by the rear center about the front rod center *O* as a center. If *O* is above the spring axis or too high, a heavy load will have a tendency to loosen the brakes, making it impossible, if the front center is very high, for the operator to apply the brakes. Or often, when it is possible to set the brakes with the load on, when the load is removed the brakes will be so firmly set it will be impossible to release them. This can easily be seen from the figure. Under full load, the difference between the curves is such as to throw the front rod center forward, while at the check position in rebound the difference is such as to pull it back. When the front center is too low, as in this case, the effects are just the opposite. When a load is applied the brakes become set, and when it is removed they are loosened. Often, in such a construction, when the brakes are set and a load is put on, it becomes impossible to release the brakes without removing the load, or when it is possible to set the brakes after the load is on, when the load is removed the brakes are loose.

Incorrect Length of Rod Causes Error

Further than this, there is an error due simply to incorrect length of rod. If the front rod center *O* is behind the spring axis *S* as shown in Fig. 2, thus making the rod too short, the application of a full load has a tendency to tighten the brakes because the difference between the curves at the extreme is such that the rear center is pulled forward. When the front rod center is in front of the spring axis *S*, thus making the rod too long, the tendency is to loosen the brakes, because the difference between the curves in this case is such as to push the near center back.

Of course, there would usually be no real action upon the brakes as long as the pedal movement was unrestricted, because such errors will first be absorbed by pedal movement until the full sweep of the pedal has been reached. Designers have many times used a slotted rod or clevis to overcome this. But this movement is often so much that it is objectionable, as well as being actually a feature of reduced safety when quick and positive action of the brakes is reached.

However, the effect is much less when a rod is simply too short or too long than when *O* is too high or too low.

Now to locate the correct position of the front brake rod center *O* by means of the gage, we proceed as follows:

Assuming that the correct position of the rear brake rod center *T* has been determined, we fix it firmly by means of the necessary attachments. We then apply

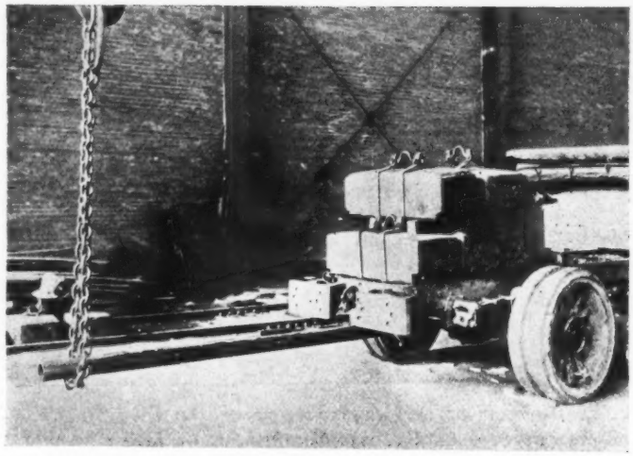

Fig. 5—Method of securing torque by chain fall and long lever on Class B truck. Note load to secure normal position of spring

the load, making the frame assume various positions above the axle, or for an easier demonstration, making the axle assume various positions under the frame.

The curve described by the torque axis *T* not being an arc of a circle, there are only three points which will be common to the arc through *T* at normal load about the spring axis *S* as a center. In other words, there are only three positions of the car above the axle where the brake action will be perfect, though if the front center *O* is placed at the spring axis *S*, the error at all other points will be reduced to a minimum, usually not exceeding a few thousandths of an inch, and will not be noticeable in action. For best results those points of perfect action should be chosen, first at normal load, and secondly, at points about three-fourths of the total movement of the spring either way from normal, or, in other words, the other two points should be located when the load is three-fourths the difference between normal and full load extreme position, and three-fourths the difference between normal and no-load extreme position respectively.

As the load is applied, readings are taken on the dial indicator, at the three points just mentioned, and are recorded in hundredths of an inch. When the three points have been reached, the records taken will indicate the relative position of the spring center *S* from the front brake rod center *O*.

For instance, suppose the front brake rod center *O* is too high, *O* moves in an arc about the countershaft *C*. The rear brake rod center *R* tends to move in an arc about the front center *O*, but it actually moves along the curve described by the torque axis *T* relative to the frame. Since under full load the difference between these curves is such as to push the rod forward, and since in the gage the front brake rod center is held stationary and the rod merely allowed to telescope, the change that takes place will be indicated by the dial gage readings. Under full load the rod will shorten and under no load or at check position it will lengthen.

Suppose at normal load the reading on the dial is 0.52 in. and at full load it has increased to 0.71 in. and finally at no load or check position due to the rod lengthening it has decreased to 0.36 in. Since the check position reading 0.36 in. is less than the full load reading 0.71 in., it indicates that the difference between the curves at check position was such as to pull the rod backward, and consequently shows that the front brake rod center is too high. Therefore, when the check position reading is less than the full load reading the front brake rod center is too high. From similar reasoning, if the full load read-

ing is less than the check position reading, the front brake rod center is too low. If the front brake rod center *O* is at the correct height the two readings will be the same, though both may be wrong for correct rod length.

If the front brake rod center *O* were on a circular arc described about the torque center *T*, and also passing through the spring center *S*, the rod would be of the correct length, regardless of the distance of the front center above or below the spring center, because its length would always be equal to the distance between the torque center and spring center, which is always correct for rod length. An arc about the front brake rod center *O*, in this case, which passed through the torque center *T*, under normal load, would reach just as far beyond the curve described by *T* at one extreme as it would fall short of it at the other. In that case the dial readings would show that the differences between each of the extreme rod lengths and the length at normal load were the same; as for instance, full load 0.67 in., normal 0.50 in., and check position 0.43 in. The differences between each of the extreme position readings and the normal readings are the same, or the sum of the extremes is equal to twice the normal. The latter method of handling the readings is the correct one, because if the rod were too short or too long but at the correct height, the difference between the extreme readings and normal reading might be the same in number of spaces passed over, but one would be a positive difference and the other a negative. This can readily be detected by simply adding the extremes and comparing the sum with twice the normal. If the sum of the extremes exceeds twice the normal the rod is too long; if less, the rod is too short.

Thus with a single set of readings we may determine our error in two directions, which enables us to make adjustments in two directions accordingly, after which we will take a second set of readings.

After the gage has been used several times it becomes an easy matter to approximate the correct amount of adjustment necessary. Usually a sufficiently correct location of the brake rod center can be accomplished in two or three readings.

When the gage was first constructed, a set of formulas was worked out which gave the correct amounts of adjustments necessary to place the front rod center at the correct position. But these formulas were rather complex and employed constants depending on the nature of the spring, and their solution usually required considerable time. After several comparative trials, it was discovered that an adjustment of the apparatus usually required less time and was more apt to be free from errors than the solution of the formulas. Consequently the formulas have been discarded in favor of simple adjustments of the apparatus, and, to further facilitate matters, easy means of adjustment have been provided on the gage.

From this one can readily understand it is not a difficult matter to have practically perfect acting brakes. When these centers are correctly located for any of the various styles or designs of chassis, one will find no further trouble with brakes due to spring action on rough roads, varying loads and Hotchkiss drive.

—

Testing Gasoline Content of Natural Gas

THE Bureau of Mines, Department of the Interior, has designed at its petroleum experiment station at Bartlesville, Okla., a testing apparatus for determining the gasoline content of natural gas. This apparatus is now in use and has been found to give exceedingly good results on gases containing as little gasoline as 10 gal. per 1,000,000 ft.

A valuable feature of this apparatus is that, with four compartments, the last compartment can be used as a test to see that the absorbing medium of the first three compartments has completely removed the gasoline from the gas. This is accomplished by keeping the percentage of saturation in the fourth compartment around a fraction of 1 per cent. Under such a condition an individual test can be made on the discharge gases from the first three compartments in which the saturation almost always rises to a point between 1 per cent and 11 per cent of the total volume of the liquid.

In a test made recently to determine the value of certain gas in the notoriously dry gas field of southern Kansas the apparatus checked itself consistently, proving recoverable yields from 10 gal. to 60 gal. per million.

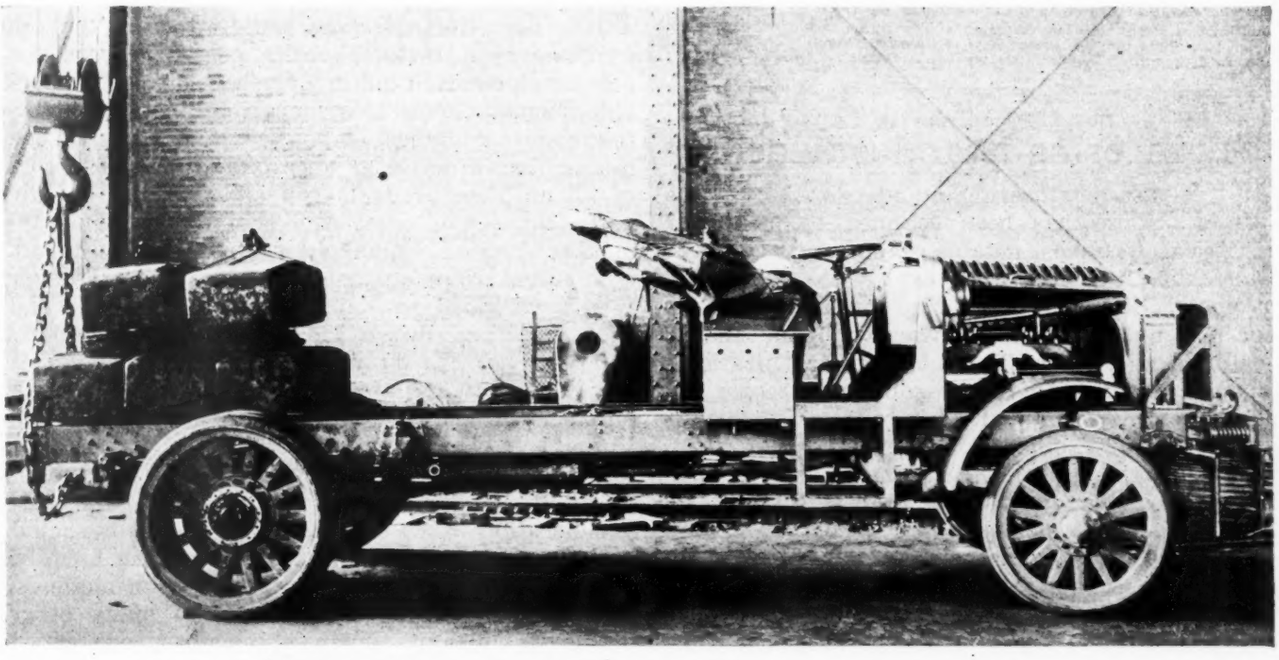

Fig. 6—Chain fall and weights used to locate spring center on government Class B truck and to secure different degrees of deflection

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The Automobile

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Engineering Standardization

IN the past, engineering standardization in the United States has been confined to particular industries. The most notable example of such work is undoubtedly that carried out by the Society of Automotive Engineers, but effective work has been done also by the Electric Power Club, the Master Car Builders' Association and other organizations. As the advantages of standardization become apparent from its results on the industries by which it was adopted first, other industries are taking it up, and one of the latest associations to devote their attention to the subject is that of the gear makers.

So far there has not been in this country a body having control of engineering standardization in general and seeking to correlate the efforts of the different groups working in that line. That there is need for such a body is quite apparent. The chief reason is that each of the standards committees standardizes not only the products of its particular industry but also the raw material and semi-finished products which are used by this industry and purchased from outside sources. Now, these same raw materials and semi-finished products are used also by other industries, and if each of the industries taking up standardization should formulate its own standards for such materials, standardization, instead of a blessing, would prove a curse. A case in point is that of steel. The Society of Automotive Engineers has standardized a great many steels used in the manufacture of automobiles and other automotive apparatus. It has assigned a number to each steel, given the required chemical composition, worked out suitable heat treatments and made a beginning in tabulating the physical properties of these steels as affected by heat treatment.

Now, steel is used by all or practically all of the engineering industries, and if any considerable number should attempt to draw up standard specifications without regard to what has already been done it would lead to endless confusion. Even a change in the numbers which are used to designate certain grades of steel would be objectionable.

It is mainly because certain matters calling for standardization are of such wide import that there is need for a general standardization committee representing the entire engineering world. Such a committee, we understand, has been formed from the membership of the five great engineering societies. The actual work of standardization, the creative work, as it were, must necessarily be done by men in very close touch with the particular industry or branch of industry to which the standards apply, but there is a promising field for the general organization in supervising the work of the different branches so as to avoid overlapping of effort.

A National Automotive Body

LEGISLATION such as that which resulted in the new North Dakota law, providing that all purchasers of tractors, trucks, passenger cars and other motor-driven machinery shall have a "reasonable length of time" for inspection and testing before final acceptance, emphasizes forcibly one good reason for an active alliance of the manufacturers of all of these products—an affiliation on a truly national basis, an association comprehensively automotive. There are many other reasons equally good.

The makers of tractors, trucks and passenger cars have much in common. Their interest and well-being are linked closely together at many points. They can do much more for themselves as members of their individual industries by working together as members of a group made up of all. United action in matters of legislation, particularly, would be immeasurably more effective than individual effort. The matter of guarantees is a basic consideration which can be, and undoubtedly should be, worked out to a standard and uniform form of warranty. In patent matters, production methods, shipping, export, merchandising and many other problems which its potential members are called upon to solve, a National Automotive Chamber of Commerce could be of very great and very general benefit.

Steam for Tractor Work

IN view of past experience with steam in the automobile and traction engine fields it seems strange that there should still be such staunch adherents of this motive power as we occasionally hear from. Steam had a good chance in the automobile field and lost out. It had the traction engine field all to itself, yet according to latest reports the steam traction engine is rapidly becoming a thing of the past. In spite of these historical facts there are people who believe that if a steam vehicle or a steam tractor built in the light of the experience of the past twelve years were placed on the market, it would prove a tremendous success. The question naturally suggests itself why steam, if it has such obvious advantages as are claimed for it, did not succeed when it had all the chance in the world; but this will be met by the latter-day enthusiast with the rejoinder that its failure was not the fault of the system but of the men who sponsored it.

The strongest argument put forward by the steam champions is that regarding fuels. As long as gasoline was plentiful there was little chance of the internal-combustion engine being replaced by another type. But gasoline is becoming scarce, relatively speaking, as is shown by the rising price, and the heavier distillates, and eventually perhaps even the crude oil, must be resorted to for use as motor fuel. We know of methods of utilizing these heavy fuels in internal-combustion engines, but unfortunately engines running on such fuels are not flexible. Steam power retains its flexibility irrespective of the fuel used. The heavier petroleum fuels are subject to a number of inherent disadvantages such as dirt and ill smell. As the supply of gasoline becomes inadequate and the price in consequence rises the heavier fuels no doubt will be adopted first for commercial types of vehicles. In fact, this has happened already, in that most farm tractors are at present designed to burn kerosene. It must be admitted, however, that much of the kerosene-burning equipment put out at present handles the fuel rather unsatisfactorily. This difficulty might be overcome by burning the kerosene under steam boilers.

Old-style steam traction engines were of very heavy construction and unsuitable for use on moderate-sized farms. This objection it is proposed to overcome by entirely redesigning the power plant, basing it on automobile and similar experience. The question then would come up as to how such lightly constructed power plants would stand the heavy vibration on tractors. Inability of the piping of a steam system to stand up under severe vibration was the greatest drawback of the early steam cars. This difficulty was gradually overcome, but there is a great deal of difference between the spring-suspended passenger car frame and the rigidly supported tractor frame.

A complete change in the system of motive-power production would certainly be a radical step, but developments in the fuel situation may compel radical changes within another decade.

Road Construction

DURING the war the building of improved roads, which had received a mighty impulse in this country during the previous five years, lapsed more or less owing to the scarcity of labor and transportation and the high cost of materials. Now that the war is over there is every reason why road building should be resumed with vigor. There is no doubt that the country is prosperous. Our exports each month exceed the imports by enormous sums. Up to date our country has lent to allied Governments nearly ten billion dollars. Additional loans are being placed here by foreign Governments right along, and the money lent them does not leave the country, but is spent here for produce, raw materials and manufactured articles. Consequently the country does not lack the capital to finance road construction.

Road work would help in solving the problem of unemployment during the transition period. While eventually the industries of the country will be quite able to absorb all of the labor released by the Army, the munitions plants and the shipyards, the change from a war to a peace footing naturally takes time, and during the interval it will be difficult to find employment for all unless the Government decides on extensive construction work. The National Government has a certain moral responsibility to lighten the hardships of the transition period as much as possible, and the state governments share in this responsibility.

Many of the roads constructed previous to the war, and which have borne heavy traffic during the past two years, are in sad need of repairs. It is a known fact that a well-surfaced road, when holes once develop in it, goes to pieces very rapidly unless it receives immediate attention. During the past two years this was in many cases impossible, and many of the improved State roads have got into bad shape. These should be repaired at once.

Aside from repair work, the road-building programs of the several states that were interfered with by the war should be resumed immediately. The country has the necessary money, men and materials, and in no other way could it invest its surplus energy and its surplus wealth to such advantage as in the building of a well-constructed highway system.

Latest News of the

Protest Government Steel Price

Leaders of Industry Want Return to Supply and Demand—Alloy Steel Market Easy

DETROIT, April 22—That the Government must withdraw its minimum of $2.60 on steel in order to stabilize conditions, is the opinion of industrial leaders in the automobile field. These men feel that present prices are largely inflated, due to the establishment of the Government minimum, and that as soon as Washington allows them to get back to a supply and demand basis, business will move along far more stable lines.

Many of these industrial leaders have visited the mills and find them working far below capacity, showing that the demand is not of such a volume as would normally cause the maintenance of this high price. It is also apparent that if the price were allowed to come down to its own level, the mills would find an increase of business volume at once.

The alloy steel market is exceptionally easy, and automobile and parts manufacturers are finding no difficulty in securing quick delivery on all of the alloy steel they desire at reasonable prices. The only alloys which are causing any apprehension are the vanadium products, due to an alleged shortage of vanadium in this country. It is stated that ferrovanadium which was stored in this country by the Vanadium Co. of America has been practically used up. It is also stated that but very little vanadium has been brought into the country during the past 2 years, on account of the lack of ships, and furthermore there has been a slip, or landslide in the valleys containing the ore producing the highest percentage of vanadium. Miners, therefore, have been compelled to use the ores containing much lower percentages until such time as the slip can be cleared away.

There is no one in the industry who feels competent to judge exactly what is going to happen to steel prices. In the first place, no one knows what Washington is going to do, and in the second place, conditions are such that all sorts of theories can be drawn from the situation, all of which sound reasonable, but are not conclusive. The opinions of leading purchasing agents in the field vary widely. There are some who even believe that the price of steel is due to take an upward rise on account of the release of heavy buying orders which have been held up during the government adjusting period.

It is believed that as soon as Washington removes its restrictions on the steel price, labor cost and living cost in the mill area will drop also. It is felt that the Government is unduly supporting labor and encouraging it in demands which prevent a firm adjustment.

Pending action by Washington, matters appear as if they were going to remain in their present uncertain state, resulting in a general tendency for buyers to use every precaution to protect themselves in advance releases.

—

$400,000 in First Overland Profit Share

TOLEDO, April 22—Willys-Overland employees Monday received $400,000 in checks in the company's first distribution of profits under the 50-50 profit-sharing plan announced in January. Approximately 15,000 shared in the profits, representing 9,843 at the plant here. The others are employees scattered throughout the country. The $400,000 represents 8 per cent of the wages paid during the first quarter of the year.

—

Maxwell-Chalmers Merger Effected

DETROIT, April 23—It is stated here by a high official of the Chalmers Motor Car Co. that the proposed merger between that company and the Maxwell Motor Car Co. has been effected. Details have not been made public. It will probably take about 10 days to work these out.

In New York, banking interests are non-committal, and in a statement given out to-day the merger is neither denied nor affirmed. The statement says: "It is true that the respective boards of directors of the Maxwell and Chalmers companies view favorably a combination of their interests, and those in control of affairs of both companies have been working toward that end, but the matter has not yet progressed sufficiently to make announcement of the details of the plan."

—

Rickenbacker Welcomed in Chicago

CHICAGO, April 23—Eddie Rickenbacker, spoken of by Lieut.-Col. H. M. Byllesby and George M. Graham in their welcome to America's ace of aces as "the epitome of the motor industry's effort in winning the war," was the guest of honor at a banquet to-night at the Congress Hotel, given under the auspices of the Chicago Automobile Trade Assn. About 800 men connected with the automotive trade in Chicago and the Middle West were present.

—

Hubbard Machine in SKF Industries

NEW YORK, April 22—The Hubbard Machine Co. will also be included in the consolidation, taking in the SKF Ball Bearing Co., the Hess-Bright Mfg. Co. and the Atlas Steel Ball Co., under the name of the SKF Industries, Inc.

Millions Being Invested in Canadian Plants

American Factory Sites Sought in Border Cities Under 6½% Preferential Tariff Lure

DETROIT, April 22—Every indication points to the establishment of scores of branch factories in Canada by United States manufacturing plants. At Windsor, Ont., it is estimated that $12,000,000 will be spent by Detroit, Toledo and Michigan companies alone. According to the Border City Chamber of Commerce, 93 big corporations are negotiating with that organization for factory sites in Windsor and its neighboring border cities.

General Motors Corp. is preparing to invest $6,000,000 in a plant at Walkerville, buildings totaling approximately $3,000,000 to be erected this year. The Maxwell-Chalmers Co. will spend $1,000,000 in new units and additions to its present plants. The Champion Spark Plug Co. proposes a $300,000 factory at Windsor, and the Auto Specialty Co., St. Joseph, Mich., contemplates a $250,000 establishment. Kelsey Wheel Co. is building additions which will nearly double present production. Motor Products Co. will soon start work on a big plant to care for Canadian trade. The Canadian Steel Corp. is progressing steadily with its $40,000,000 plant at Ojibway.

The Republic Motor Truck Co., Alma, Mich., has decided to locate its Canadian plant at London, Ont. A building site there has been selected and work on the new establishment will start immediately. During the course of erection an old munition factory will be used for the stocking of parts and possibly some assembling in a small way until the new factory is ready.

The 6½ per cent preferential tariff, which Great Britain has put in effect to assist the Dominion in expanding her export trade, is the bait drawing American manufacturers to the border cities.

This tariff supersedes the embargo on Canadian goods, giving them free access to the British Isles and all British possessions. The ruling of the British War Board, that articles assembled in Canada are to be considered Canadian goods, has reacted very favorably upon the American manufacturer, who sees in a Canadian assembly plant an open road to the British foreign market.

The movement of automotive parts makers, which is causing them to establish branches in Canada, gives the Detroit automobile manufacturer the opportunity to build his car in Canada from Canadian made parts almost complete with the exception of a few major units.

Automotive Industries

Lack of Skilled Labor in Detroit

Return of 85th Division With 3000 Skilled Mechanics Eagerly Awaited—Local Restlessness

DETROIT, April 22—There is a marked and rapidly growing labor shortage in this city and vicinity. Three months ago there were 35,000 men out of work and Detroit was wondering what to do with its returned soldiers. To-day Detroit is clamoring for the return of the 85th Division, now on its way home, and which includes nearly 3,000 of Detroit's skilled mechanics. Unskilled labor is plentiful.

The situation in neighboring towns is similar. In Flint, Jackson, Lansing and other small industrial centers in Michigan and Ohio there is a demand for skilled workers. Toolmakers are a rarity. And yet labor in this vicinity is restless. Toledo is the focal point of unrest, and has a number of strikes in various industries now in progress. Detroit also has a number of workers in various industries out, but only one prominent concern in the automobile business has been affected, and this strike has been practically broken.

Toledo Feels Effects, Too

In Toledo the workers at the Bock Bearing Co. are out, demanding higher wages and an 8-hr. working day. The workmen at the Willys-Overland Co. have presented a set of demands calling for wage increases, running up in some instances as high as 40 per cent. The demands were refused by the Overland company, which is at the present time making a thorough reclassification of its wage rates to bring them in line with what is paid at other plants in similar lines. These will be finished within a few days. In addition to this, the company made its first quarterly distribution of profits yesterday, amounting to $400,000. This had a marked steadying influence on the workmen, and it is thought that the unrest will soon blow over.

At the Wadsworth Mfg. Co., Detroit, where a great many closed Ford bodies are manufactured, 1500 automobile body builders have quit. This company refused to recognize the union and has taken practically all the heart out of the strike by to-day announcing a profit-sharing plan, with a minimum wage scale of $6 per day, patterned exactly after the Ford plan. This concern operates 8½ hr. per day, with no work Saturday afternoon. No shut-down was necessary, as the Ford Motor Co. continued operations with its own workmen.

What troubles there are are confined to the large centers. In the smaller manufacturing towns the stable element, composed of older men and men who are property owners, is in a much greater proportion. Outside agitators are not successful in the smaller towns, and there is a far greater feeling of content. Furthermore, the co-operation between municipalities and labor is much closer, because in the smaller towns the manufacturing element has a greater control of the city's affairs. The result is that matters are conducted along lines which are of the greatest advantage to the workmen. An example of this is shown in the case of Flint, where co-operation with the merchants and manufacturers resulted in a 15 per cent decrease in the average living cost.

It is the younger element which is at the bottom of most of the trouble, and the returned soldier is not idle either. Hundreds of young men who, while single, lived very well on their wages, married immediately upon their return from service. They have gone back into the shops, and while their pay-checks are somewhat larger than before the war, the extra expense of a wife and home has caused the wage problem to become one of vital importance. When a movement for increased pay is started these young men may usually be found backing the movement to the limit.

The soldier is also returning with his head full of exaggerated high-wage stories picked up overseas and in training camps. He had heard of high wages paid during the war and expects the same scale to be continued. He thinks practically every man in the shops received from $10 to $12 daily, and it is hard for him to believe that most of the high-wage stories were myths. In certain trades experts working on a piece basis did make exceptionally large wages, but such cases were but a moderate percentage.

These men apply for jobs and at the outset are disappointed with the scale. They are continually quitting and going elsewhere, hoping to better themselves. This attitude spreads to others, and as a result the labor turn-over this spring is 50 per cent more than last year. A great many of the automobile workers are joining the United Automobile, Aircraft and Vehicle Workers' Union, which is a new but strong organization and which, like a great many new organizations of this kind, seems anxious to test its strength.

Goddard Joins Militor

NEW YORK, April 24—H. A. Goddard has been appointed director of sales and advertising of the Militor Corp., New York, which last week was merged with the Knox Motors Co., Springfield, Mass.

For several years Mr. Goddard was connected with the Standard Parts Co., Cleveland, as export manager and eastern representative, located in New York, and later in charge of sales for the State of Michigan, with offices in Detroit.

English Import Bars Let Down

To Permit Entry Until Sept. 1, 1919, of Five-twelfths of Automotive Apparatus Imported Between Jan. 1 and Sept. 1, 1913

NEW YORK, April 24—England has let down the bars against American automotive products. Effective immediately, the Controller of Import Restrictions will allow entry into England under license of 50 per cent of the number of motor cars, motor trucks, motorcycles and accessories imported between Jan. 1, 1913, and Sept. 1, 1913.

The restriction to this amount is to be maintained until Sept. 1, 1919, and applies also to forgings and castings for motor vehicles. Spare parts, however, are to be admitted freely under license, but only for renewal purposes and to repair such vhicles as are now in use. All imports are to be licensed in proportionate monthly quantities.

Each importer must apply for an individual import license and submit a sworn statement as to his imports during 1913. According to a cable from Consul-General Robert P. Skinner, London, the term automobiles is stated to cover motor vehicles of all kinds. Though trucks are not specifically mentioned, it is understood that they are included.

First information regarding the letting down of the bars came to the N. A. C. C. in a cable from C. C. Hanch, who is at present representing that body in England. This has since been confirmed by the Bureau of Domestic and Foreign Commerce in Washington.

Records of this bureau are not arranged by calendar years. However, the following figures will give some idea of American imports during the 1913-1914 period:

	1913		1914	
	Number	Value	Number	Value
Cars	2,783	$2,893,785	6,992	$5,615,487
Trucks	184	119,468	203	189,099
Motorcycles	1,036	203,734	1,604	320,009
Parts	...	922,866	....	1,282,388

If the five-twelfths referred to means the months of April, May, June, July and August, then half of the sum of the two years, divided by two to give one-half year, approximately, will permit about 40 trucks and 1120 passenger cars to be imported.

Would Break Patent Licensing Plan

Locomobile Sues N. A. C. C. Over Agreement—Alleges It Hampers, Not Helps

NEW YORK, April 23.—The Locomobile Co. of America, whose president, Andrew L. Riker, was a vice-president of the National Automobile Chamber of Commerce at the time that body proposed and adopted its patent cross-licensing plan, and who is at present a member of that body's patent committee, is suing the National Automobile Chamber of Commerce for annulment of the entire cross-licensing agreement.

The importance of the suit may be judged in part by the fact that in principle it involves some 500 patents, which, since the agreement became effective Jan. 7, 1916, have been pooled by the 112 members of the association.

The suit is entirely a friendly one. The relations between the Locomobile company and the N. A. C. C. have always been entirely cordial. The Locomobile company believes, however, that the patent cross-licensing plan operates to defeat inventive genius and to "obstruct and prevent the natural development of the automobile." It is also alleged that the "inevitable effect of the agreement is actually to prevent the members of the respondent (N. A. C. C.) from making any effort toward, or incurring the expense of, developing and devising new inventions and obtaining patent protection therein, since, by so doing, the entire automobile industry is forthwith, by the terms of the agreement, given an equal right in and to the new inventions without paying any consideration therefor, not even to the extent of reimbursing the party who devised, developed and patented the invention, or any part of the cost thereof."

In further detail the complaint alleges that the arrangement tends to prevent manufacturers maintaining desirable and necessary engineering departments; that it has deterred members from developing new inventions and that in consequence of this and other charges a "great injury has been done to the automobile industry and the normal progress of the art has been interfered with, obstructed and impeded instead of being promoted as public policy requires."

The complaint alleges further that because of the situation which it outlines, the Locomobile company cannot, "with proper regard to its own interests, continue originating and experimental work and devising and working out inventions."

It is also claimed that the agreement operates as an undue and unlawful restraint upon trade and that it was "so conceived and put into effect by a few members of the respondent who conspired together to induce manufacturers of motor vehicles to execute the agreement not for the purpose as alleged therein, of avoiding patent litigation, but to secure to the respondent a virtual monopoly in and the control of the patent field of the industry, thereby increasing its power and influence therein and giving it the authority to dispose of property of incalculable value."

The Locomobile company asks in its complaint:

1—That the respondent, National Automobile Chamber of Commerce, its attorneys, counselors, officers, agents, employees and servants be enjoined from taking any steps to enforce the cross-licensing agreement referred to in the bill of complaint as against the "Locomobile" Company of America, or any other signer thereof, or from granting any licenses or taking any further action under the terms and provisions thereof, all until the further order of this Honorable Court.

2—That this Honorable Court shall order and decree that the cross-licensing agreement referred to in the bill of complaint is null and void in law, and that it be canceled and all rights acquired by any parties thereunder be restored to those parties who granted such rights under the terms of the aforesaid agreement.

3—For such other and further relief as to this Honorable Court may seem meet.

The complaint recites in detail the modus operandi of the agreement, which in brief is as follows:

The agreement was not to become effective until at least 61 manufacturing members had put into the pool at least 300 patents, and between April, 1915, and Jan. 7, 1916, this condition had been complied with and the agreement became effective on the latter date. It is to remain in force until Jan. 1, 1925.

Patents are designated "A" when they are what may be termed development patents, and "B" when they cover design "of a striking character, involving a radical departure, or a radical change, from what is known and resulting from an inventive effort of a high order, rather than a mere improvement. . . ."

Members were required to pool only their so-called "A" patents, in return for which they were given the privilege of using some 500 other "A" patents which already had been placed in the pool.

French Factory Adopts 8-Hour Day

Gnome & Rhone First to Introduce Change

PARIS, April 1—The Gnome & Rhone aviation and automobile company introduced the 8-hour day this week, with one shift. In this factory work now begins at 7:45 a. m. and finishes at 4:15 p. m., the workmen having half an hour for lunch, this time being paid them at full rates.

This is the first time a single shift 8-hour day has been tried in France. Laurent Séguin, head of the Gnome factory, concluded that there was considerable inefficiency under the 10-hour day, which began at 7 in the morning and finished at 8 at night with a 2-hour stop at midday for lunch. Under this system life was monotonous. Two of the best hours of the day were lost in eating, or in going to and returning from home. After the heavy midday meal there was at least one hour during which inefficient work was accomplished.

Before the single shift 8-hour day could be adopted it was necessary to provide dining halls for the men. Under the French factory act it is forbidden for workers to eat in the shops. Since the armistice, the Gnome company has been able to transform some of its buildings into dining halls, where men can eat without going off the premises and without any loss of time.

"Reasonable Time" to Inspect Tractors

North Dakota Law Permits Buyers to Rescind Sale on Machines "Not Satisfactory"

FARGO, N. D., April 22—Hereafter North Dakota farmers who purchase tractors are to be given a "reasonable time" in which to decide whether they are satisfactory or not.

At the last session of the North Dakota Legislature a bill was slipped through giving them this privilege, and the bill has been signed by Governor Frazier. Under the terms of the measure the purchaser is given "a reasonable time after delivery for the inspection and testing" of the machine, "and if it does not prove to be reasonably fit for the purpose for which it was purchased the purchaser may rescind the sale." Following is the complete text of the bill:

Section 1. Reasonable time to discover defects. Any person, firm or corporation purchasing any gas or oil burning tractor, gas or steam engine, harvesting or threshing machinery for their own use shall have a reasonable time after delivery for the inspection and testing of the same, and if it does not prove to be reasonably fit for the purpose for which it was purchased the purchaser may rescind the sale by giving notice within a reasonable time after the delivery to parties from whom any such machinery was purchased, or the agent negotiating the sale or made delivery of such personal property or his successor, and placing the same at the disposal of the seller.

Section 2. Provisions contrary to the preceding section void. Any provisions, any written order or contract of sale or other contract which is contrary to any of the provisions of this act is hereby declared to be against public policy and void.

Some little apprehension is felt over the indefinite language of the bill. It is thought that interpretations will be generally in favor of farmers who may be disgruntled or dissatisfied over some little thing which might ordinarily be fixed at very small expense.

Despite the possibility of remedying such slight defects, however, the bill specifically gives the farmer the right to refuse the manufacturer the privilege of making them. Tractor men feel that they face a serious situation.

As a companion to this law another was passed by the same legislature and also signed by the Governor which provides that manufacturers selling tractors in North Dakota must maintain at least one supply depot within the State and keep in it a full and complete stock of repairs. Following is the text of the measure:

Section 1. On and after the taking effect of this act it shall be unlawful for the manufacturers of any gas or oil burning tractors, steam or gas engines, harvesting and threshing machinery, automobiles and auto trucks to sell or deliver within this state any such gas or oil burning tractor, steam or gas engine harvesting and threshing machinery, automobile or auto trucks without having first established at least one supply depot within the state where shall be kept constantly on hand a full and complete supply of repairs for the same.

Any manufacturer selling or delivering or causing to be sold or delivered any such machinery in violation of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined not less than $25 and not to exceed $200 for each offense.

Legal Standards for Gasoline Proposed in California

Three Bills Now Before State Legislature Fixing Standard Specifications for Fuel and Lubricants and Providing for Inspection and Analysis Are Opposed by Automotive Trade and Oil Producers

SACRAMENTO, April 17—Three separate efforts to standardize gasoline specifications by legislation are represented by as many different bills now before the California State Legislature. These bills seek to define gasoline and fix a standard of quality. One of them also defines distillate, fixes a standard for this product and provides for its coloring "in a manner sufficient to show clearly if one part of same is added to seven parts of gasoline." The third bill is entitled "an act to prevent the manufacture, sale or compounding of adulterated or misbranded gasoline, benzine, naphtha, lubricating oils and greases, etc., and to regulate the traffic therein and providing for their inspection, analysis, standard grades and standard tests."

These bills are naturally meeting with the opposition of the trade in California and it is expected that they will receive due attention from the industry as a whole because of the widespread consequences which would result from misdirected attempts at legislation of this kind.

In his report on these bills, filed with the Committee on Oil Industries, G. M. Swindell, secretary of the Chamber of Mines and Oil of California, said the following:

There are three bills before the present session of the California State Legislature which propose to fix specifications for gasoline and make certain other restrictions in connection with petroleum products.

Defines Quality of Gasoline

Senate Bill 127, introduced by Charles W. Lyon of Los Angeles, provides that the standards of quality and strength for gasoline, benzine, and certain other petroleum products shall be those adopted or that may be adopted by the U. S. Bureau of Mines, with the proviso, however, relating to gasoline, that it shall have a specific gravity of 60 deg. Baumé.

Discussing the principal provisions of this proposed bill, it might be said, first, that the U. S. Bureau of Mines does not fix standards, and cannot reasonably be presumed to fix standards in the future. Furthermore, if the Bureau of Mines were to fix standards for gasoline, it is certain that the qualified technicians on the bureau's staff would not mention gravity as a controlling factor of such specifications.

The gravity test for gasoline, as every automotive engineer and practically every business man interested in the automotive industry understands, was cast into the discard long since—it being amply demonstrated as of no scientific nor practical value. It is also a well-known fact to both automotive engineers and oil refiners that, even though scientific investigation had not demonstrated the fallacy of this test, the constantly increasing demand for gasoline of the quality manufactured years ago (with no corresponding proportionate increase in gasoline-producing crude petroleum) would have made the price of that particular product prohibitive; or, with a limited supply available, the development of the automotive industry in its various branches would have been seriously hampered.

Assembly Bill 108, introduced by Assemblyman Samuel Knight of San Bernardino, merely proposes to establish a standard for gasoline of 60 deg. Baumé at 60 deg. Fahr.

Introduced by a Layman

This bill, introduced by a layman, is typical of the lack of knowledge of the average man, even the average user of gasoline, of what would constitute gasoline specifications. It is not believed at this writing that it will be given any consideration by the legislature.

Senate Bill 711, introduced by Senator W. B. Shearer, at the request of the State Superintendent of Weights and Measures, as originally introduced, is also typical of what may be expected from superficial knowledge of such a complicated subject.

As originally introduced this bill defined gasoline as "a petroleum product obtained through the distillation of crude petroleum, water white, refined and free from all impurities." Its provisions, if it had been enacted as originally prepared, would have entirely eliminated casing-head gasoline from the California markets, and during 1918 we produced over 600,000 barrels (over 25,000,000 gallons) of this product, which was scientifically blended with distillate, a refinery product, and helped take care of the enormous demand for gasoline during that year.

One of the few sensible matters in this proposed bill was that its proponents specifically set forth that gasoline should be subjected to test in accordance with the distillation method set forth in Technical Paper 166, U. S. Bureau of Mines. However, later the chemist for the Superintendent of Weights and Measures decided that he would prefer not to use any cotton on the bulb of the thermometer, as prescribed in this method of testing, and proposed to incorporate an amendment eliminating its use.

It was originally planned to contest the passage of this bill because of its inconsistencies and incongruities; also because of the lack of knowledge of the situation shown by its proponents. However, better counsel prevailed, and after a number of conferences with the Superintendent of Weights and Measures, he was finally persuaded to amend the proposed bill in some particulars, substituting the so-called "navy specifications" with a 428 deg. end point for those he proposed. He at first "stood pat" on his definition of gasoline, but at to-day's writing he is convinced of the inadvisability of eliminating casing-head gasoline as a part of the available supply, and has intimated, somewhat reluctantly, that he will submit an amendment with that idea in view.

The chemist for the superintendent has also agreed to a specification of 10 milligrams of cotton on the bulb of the thermometer.

Bill Rewritten

The bill as originally proposed has been practically rewritten, and is now under consideration by the committee of the California state senate, in its amended form. As amended, after the several conferences with the superintendent of weights and measures, we have a reasonably logical bill against which we can present arguments and have eliminated its ridiculous features.

There are certain broad aspects connected with this question of fixing specifications in which both automotive engineers, the automotive industry and the oil refining industry are interested.

The particular problem confronting the oil industry to-day is one of utilization of petroleum and its products to the best possible advantage, consistent with the laws of supply and demand, and having in mind a desire to maintain reasonable and uniform prices to the consumer.

The principal outstanding fact for consideration is the production in California of gasoline-producing crude petroleum. Gasoline is not made from crude petroleum, but is extracted from it. No cracking processes have yet been developed to handle our asphalt-base crude oil, though thousands of dollars are being spent monthly by the California refiners to perfect such processes. It will be conceded, in the light of production figures which I will give you, that the development of such processes will aid materially in the solution of our problem, and may even permit California refiners to help the Middle West and East.

We produced in California in 1918 in excess of 100,000,000 barrels of crude petroleum.

Of this production, approximately 50 per cent has no extractable gasoline content, and was burned as fuel under the locomotive and industrial boilers of the territory we serve.

According to statistics compiled by the Pacific Coast Petroleum Administrator, operating under the U. S. Fuel Administration, our total production of gasoline in 1918 was 7,000,000 barrels.

This production was made up of 6,400,000 barrels from refineries and 600,000 barrels of casing-head gasoline.

It has been the custom of California refiners to accumulate appreciable stocks of gasoline during the winter months, to enable them to care for the demand when the "peak-load" arrives, during the months from June to November.

Our production for 1917 was 5,700,000 barrels, and on Jan. 1, 1918, we had in stocks on hand 813,443 barrels. However, notwithstanding a production of 7,000,000 barrels in 1918, an increase over 1917 of 1,300,000 barrels (with no corresponding proportionate increase in gasoline-producing crude), we only had available on Jan. 1, 1919, in stocks on hand, 573,372 barrels.

And this situation developed during a period when every effort was made to curtail the use of gasoline and eliminate its waste. Furthermore, this stock on hands of the large refining companies, and our small refineries, notably in the southern part of this state, are operating to-day on a day-to-day basis in supplying their trade, and have been unable to accumulate any stocks to care for the certain increased demand to come in summer.

In California, with a constant decrease of stocks on hand; an enormous increase in the price of gasoline-producing crudes; with a 24-gravity oil selling at $1.30 per barrel at the well; facing a yearly increase in consumption of between 20 and 30 per cent; and with no immediate indication of any increase in gasoline-producing crude production, we are face to face with a problem which requires the most careful and serious consideration when one considers the fixing of gasoline specifications to endure for a period of two years.

If the proposed specifications were contained in a city ordinance, there would be little or no criticism. City ordinances can be promptly corrected to meet changed conditions, but a state law remains in effect for a period of two years, and must be subject to continual and deliberate violation, or the users of the product in that state must be deprived and shipments made to localities lacking onerous restrictions, or those with which it is impossible to comply.

A Problem for Business Man and Engineer

This is a mutual business problem, not legislative, and must be solved by representatives of the automotive and oil industries. The refiners can only furnish the automotive industry with the extractable gasoline in the crude produced; and automotive engineers must provide power-producing engines which will use to advantage the power product available. The question is really one of securing thermal efficiency, and it is to this feature of the problem that automotive engineers must direct their attention.

The pressure upon the oil industry, both the production and refining departments, of the demands from the automotive industry, has caused a material change in the supply of motor fuel, and there is a real danger of reaction to the disadvantage of the consumer.

It is obvious that when you fix by law the quality of a product, you must of necessity automatically regulate the price of that commodity, provided the supply and demand continue uniform; but should the supply decrease, or should the supply remain normal and the demand increase, it necessarily follows that some one must be deprived of the product, or more naturally, that the constantly increasing demand will force higher prices for the available product.

Exports of Cars, Trucks and Parts by Countries for February, 1919

Countries	Commercial Number	Commercial Value	Passenger Number	Passenger Value	Parts Value
Belgium	...	.....	3	$12,400	$1,710
Denmark	5	$13,035	36	48,289	4,653
France	670	3,035,379	82	281,131	203,788
Greece	10	25,720	21	38,906	23,949
Italy	1	2,731	1	1,500	500
Netherlands	...	.....	...	.....	190
Norway	31	75,175	26	28,874	7,271
Portugal	...	.....	2	3,500	2,098
Spain	1	1,145	36	43,665	9,497
Turkey in Europe	59	97,305	27	13,878	13,026
England	9	14,247	3	2,836	760,302
Scotland	...	.....	...	.....	13,111
Ireland	...	.....	...	.....	700
British Honduras	...	.....	...	.....	781
Canada	128	132,873	281	290,788	579,102
Guatemala	...	.....	...	.....	269
Honduras	1	300	...	.....	990
Nicaragua	...	.....	4	3,616	2,187
Panama	1	550	6	6,150	5,819
Salvador	...	.....	7	9,346	1,206
Mexico	47	42,416	203	149,536	45,324
Newfoundland	...	.....	5	5,779	362
Barbados	...	.....	3	2,499	159
Jamaica	...	.....	1	1,000	4,716
Trinidad	6	3,300	9	5,670	7,163
Other Br. W. Indies	3	1,650	1	595	2,547
Cuba	34	92,429	...	290,807	141,141
Virgin Islands	1	3,350	...	.....	74
Dutch West Indies	...	.....	4	2,737	250
French West Indies	1	1,800	2	2,151	3,660
Haiti	1	550	21	22,344	930
Dominican Republic	...	.....	5	9,346	1,627
Argentina	11	21,794	213	324,193	38,287
Bolivia	...	.....	...	.....	536
Brazil	5	9,765	121	148,673	87,869
Chile	3	7,672	64	152,919	57,331
Colombia	...	.....	3	2,301	4,375
Ecuador	...	.....	2	2,734	2,242
British Guiana	...	.....	2	1,025	992
Dutch Guiana	...	.....	...	.....	41
Peru	4	10,540	77	147,961	24,845
Uruguay	1	1,070	25	38,106	17,621
Venezuela	2	1,360	24	27,346	10,920
China	19	45,530	112	145,383	19,379
British India	6	11,700	44	58,428	60,214
Straits Settlements	7	21,150	2	2,055	21,538
Other Br. East Indies	...	.....	...	.....	16
Dutch East Indies	23	62,923	72	72,911	33,542
French East Indies	...	.....	16	19,736	.....
Hongkong	16	19,792	30	38,493	1,342
Japan	183	292,294	199	265,508	31,520
Siam	...	.....	35	27,464	630
Turkey in Asia	10	14,500	10	6,978	2,756
Australia	16	15,678	493	447,408	135,291
New Zealand	43	78,372	222	225,262	84,662
Other British Oceania	...	.....	...	.....	802
French Oceania	...	.....	...	.....	50
German Oceania	...	.....	...	.....	67
Philippine Islands	38	90,627	131	125,943	55,130
British West Africa	2	3,276	...	.....	1,077
British South Africa	1	18,544	140	159,483	86,574
British East Africa	...	.....	1	982	271
French East Africa	...	.....	1	800	8,547
Morocco	...	.....	...	.....	6,121
Portuguese Africa	...	.....	...	.....	134
Egypt	...	.....	...	.....	5,917
Total	1,403	$4,270,542	3,041	$3,719,485	$2,699,741

This table supplements the one which appeared in the March 27 issue of AUTOMOTIVE INDUSTRIES, *and gives figures for all of the individual countries, including those generally grouped under the collective heading "Other Countries."*

Foreign Trade Boom Continues

WASHINGTON, April 19—Exports and imports for March continue to show a large increase as compared with previous months, according to figures received by the Bureau of Foreign and Domestic Commerce. Exports for March totaled $605,000,000 as compared with $508,000,000 in February and $523,000,000 in March, 1918.

For the 9 months ended March, 1919, exports totaled $4,991,000,000, an increase of $600,000,000 over the corresponding period last year. Imports for March totaled $268,000,000 as against $235,000,000 in February and $242,000,000 for March, 1918.

Government Opposes Gasoline Combine in Trinidad

WASHINGTON, April 19.—The government of Trinidad, British West Indies, has taken steps against a gasoline combine by which prices of gasoline have been increased to 48 cents per gal. The consumption of gasoline in Trinidad is 360,000 gal. a year, used chiefly for automobiles, and up to two years ago local dealers buying their supplies from the United States, paid 28 to 34 cents per gal. About that time local oil companies formed a pool, and in order to develop and protect the local companies, the government granted them exclusive use of a government warehouse, following which the combine immediately advanced prices to 48 cents.

Evidence produced at a recent lawsuit proved that gasoline sold locally for 48 cents cost only 18 cents, with an excise tax of 6 cents, making a total of 24

cents. The Trinidad government has given the local companies 30 days' notice to discontinue storage of gasoline in the government warehouse, and has invited storage of American gasoline. This offer will be accepted as soon as shipping rates, which are now prohibitive, are reduced.

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Can Ship to Leeward Islands

WASHINGTON, April 19—Exporters in the United States can now ship into the British Leeward Islands, all prohibitions against importations having been removed on all commodities.

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Can Ship Tractors to Tunis

WASHINGTON, April 19. — Farm tractors, parts and accessories can now be shipped freely without import licenses to Tunis.

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Exports of Automobile Tires, by Countries, During February, 1919

Country	Value
Belgium	$14,026
Denmark	1,670
France	61,336
Greece	21,858
Norway	26,356
Portugal	1,115
Spain	56,228
Turkey in Europe	47,512
England	176,878
British Honduras	1,288
Canada	46,688
Costa Rica	449
Guatemala	11,831
Honduras	1,676
Nicaragua	2,664
Panama	58,984
Salvador	15,178
Mexico	71,836
Newfoundland and Labrador	167
Barbados	2,243
Jamaica	20,060
Trinidad and Tobago	7,519
Other British West Indies	620
Cuba	166,085
Danish West Indies	50
Dutch West Indies	241
French West Indies	14,751
Haiti	5,686
Dominican Republic	4,545
Argentina	56,546
Bolivia	1,478
Brazil	86,349
Chile	119,129
Colombia	13,550
Ecuador	4,078
British Guiana	424
Dutch Guiana	175
Peru	40,817
Uruguay	69,105
Venezuela	19,588
China	6,421
British India	154,904
Straits Settlements	69,103
Other British East Indies	773
Dutch East Indies	57,977
Hongkong	12,477
Japan	20,414
Turkey in Asia	9,306
Australia	10,315
New Zealand	208,699
Philippine Islands	111,604
British West Africa	340
British South Africa	11,478
British East Africa	14,822
French Africa	1,600
	$1,941,012

Rubber Imports Again Double

28,223 Tons Twice February Figures—Highest March Record in Years

NEW YORK, April 18—Rubber imports for March reached a figure not attained by any single month in the past four years. The 28,223 tons of crude rubber brought in last month more than doubled the 14,079 tons for February, and as compared with 17,161 tons for March, 1918, showed an advance of 11,062 tons.

The Rubber Association of America has compiled the following list of importation figures for crude rubber for the past four years:

	1916 Tons	1917 Tons	1918 Tons	1919 Tons
January	9,162	12,788	16,084	7,235
February	1,597	10,162	13,108	14,079
March	10,070	18,624	17,161	28,223

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John Simmons Adds Truck Export Line

DETROIT, April 21—The John Simmons Co., New York, which exports hardware, machinery, plumbing supplies and other similar lines, is establishing a truck division and proposes not only to export motor tucks but to act as truck distributer in the New England States. Last year the company took over the export sales of the Nelson Truck Co., Saginaw, and the experiment was so successful, especially in the Latin-American countries, that this year it is going into the truck business on a large scale.

The Simmons Co. has just signed with the Nelson Co. to handle its distribution in all New England States, New York, eastern Pennsylvania and the northern half of New Jersey. Its export territory includes central and southern Europe, all of Asia, British Isles, Norway, Sweden, Denmark, Mexico and eastern South America.

Exports of Tractor Engines During February, 1919

Countries	Number	Value
France	561	$768,915
Turkey in Europe	10	14,564
England	810	560,879
Canada	413	407,621
Guatemala	2	1,160
Honduras	1	920
Mexico	44	39,051
Barbados	1	1,450
Cuba	9	10,250
Dominican Republic	1	1,699
Argentina	13	16,556
Brazil	27	10,240
Chile	1	2,050
British Guiana	1	2,000
Peru	25	38,875
Uruguay	21	16,500
British India	3	2,359
Straits Settlements	2	926
Japan	10	58,458
Australia	29	27,405
New Zealand	21	14,852
Philippine Islands	82	78,373
British South Africa	68	8,704
Morocco	90	61,345
Total	2,245	$2,145,152

G. E. Lyons has been made sales manager of the truck division. He was formerly with the eastern office of the Garford Truck Co. Hoyt Spelman will have charge of the export department. He has been connected with the export department of the Simmons Co. for a number of years.

The Simmons Co. will start immediately to build a warehouse on Long Island. It will be 80 x 100, constructed of concrete, steel and brick.

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1135 Tractors Sold by Canada at Purchase Price

OTTAWA, ONT., April 19—In 1918 1135 farm tractors were purchased by the Canadian Food Board of the Department of Agriculture. The price paid was $750 f.o.b. Dearborn. No duty was paid. The retail price to farmers in Ontario, Quebec, Nova Scotia, New Brunswick, P. E. I., British Columbia, was $750 f.o.b. Dearborn. The price to farmers in Manitoba, Saskatchewan, Alberta, was $795 f.o.b. point of delivery. They have all been sold.

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Conference on Weights and Measures

WASHINGTON, April 19.—A conference on weights and measures will be held here at the Bureau of Standards May 21-24. Officials are being invited from the various states, together with representatives of industry, and the discussions will relate to the present independent State legislation on weights and measures, the possibilities of changing present standards, etc.

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British Manufacturers Striving for Greater Permanence in Magnetos

LONDON, April 8—Though claims are being made for the superiority of British magnetos over the former Bosch machines, engine manufacturers are not entirely agreed upon this in that the average performance of the British-made magneto is not so high as it should be. The trouble lies apparently in the magneto lacking the required ratio of permanence of coercivity in the magnets. There is a strict ratio between these two necessary, and it is in this direction that the British magneto specialists are making special efforts.

One of the points investigated is the substitution of chromium steel for tungsten steel. Bar magnets of chromium steel, stored for a year without being exposed to any disturbance, kept their magnetic moment constant within 0.3 per cent and less. In all the cases the changes observed were within the limits of the experimental error in the second half of the year.

As regards constancy to heat variations, concussions and temperature coefficient, the chromium steel proved equal to tungsten steel, but in respect of coercive force and permanence the best chromium steel did not come up to the best tungsten steel. The temperature coefficient of the magnetic moment diminishes with increasing content of dissolved carbon and was found to be zero in a 1.4 per cent carbon steel.

To investigate the suitable ratio of length to diameter in the case of bar magnets, a chromium steel originally 22 cm. long and 0.6 cm. in diameter was gradually shortened to a length of 2.4 cm. This shortening raised the temperature coefficient from 2.4 per cent up to 4.2 per cent. The ratio of length to diameter, l/d, was also found not to be without influence on magnetometer determination of the coercive force. When the value of l/d fell below 10, these determinations gave too low values.

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American Automobiles Dominate in Dutch East Indies

WASHINGTON, April 21—The American automobile dominates the markets of the Dutch East Indies and will probably continue to do so, according to Consul A. E. Carleton, who reports that there are 12,000 cars in use in the country, and that since 1915 practically nearly all imported and sold have been of American manufacture. Previously Italian and French cars were popular. Imports in the last three years have averaged 2500 cars per year.

Special requirements for automobiles in the Dutch East Indies, which should be considered by American manufacturers, according to Consul Carleton, are an adequate cooling system, as the climate is tropical; a powerful flexible engine, because of the numerous hills and long distances, and powerful springs, because of the rough roads. Manufacturers will also do well to give more thought to the details and finish of both engines and bodies.

The truck market is comparatively undeveloped. There are only 200 in the country. Motorcycles are quite common in Batavia and Weltevreden. Government construction of highways has just been undertaken in Java, and numerous roads are being built.

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Men Needed for Air Service

WASHINGTON, April 21—The Air Service of the United States Army is in need of mechanics, including airplane, airplane engine, bench and radio makers, tool makers, metal workers and coppersmiths, balloon and airplane fabric workers, cabinet makers and balloon riggers. Enlistment in the Air Service offers advantages to the skilled mechanics, who in a majority of cases are given non-commissioned officerships. Enlistment can be made for one year if a man has had previous experience in the Air Service. Enlisted men can also learn to fly if they are physically fit and have sufficient mechanical knowledge.

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Perfex Radiator Makes Statement of Financial Condition

RACINE, WIS., April 19.—The Perfex Radiator Co., which on March 28 was made defendant in involuntary bankruptcy proceedings in the Federal court at Milwaukee, has filed schedules showing assets of $1,248,506, and liabilities of $227,319.

Wages in Industry Decrease 8.6 Per Cent

WASHINGTON, April 21—A decrease is notable in the wages paid in the automobile industry in comparison with the months of December, 1918, and January, 1919. A decrease is also apparent in numbers employed. During the month of January, 1919, 50 car makers employed 117,844 workers, as compared with 124,902 in December, 1918, a decrease of 5.7 per cent, while at the same time the wages for January, 1919, totaled $3,041,762, as compared with $3,329,139 in December, 1918, a decrease of 8.6 per cent.

Similarly, a decrease of wages greater than the decrease of workers is reported by other industries, such as car building, boots and shoes, cotton finishing, iron and steel and paper manufacture. The iron and steel industry, for example, laid off 1.6 per cent of its workers and at the same time decreased its wages 5.1 per cent.

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New Company to Make All-Steel Wheels

KENOSHA, WIS., April 21.—The Kenosha Wheel & Axle Co. is being organized with an authorized capital stock of $550,000 as a development of the Whitcomb Tool & Machine Co. The new company will specialize in internal spur-gear drive axles and a new type of all-steel wheel for commercial cars. James A. Whitcomb, proprietor of the old concern, will be president and manager of the new company. For the present the Whitcomb shops will serve as a factory, but a site is being purchased whereon to build a complete new manufacturing group.

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Fulton Stock Not to Be Sold in Michigan

DETROIT, April 22—The Michigan Security Commission has refused permission to the Fulton Motor Truck Co., Farmingdale, L. I., to sell its stock in Michigan. The stock has not been approved by the commission, which threatens to bring suit against Torrey & Co., Inc., New York brokers, who have just started a sales campaign here.

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Refined Dixie Flyer for $1,365

LOUISVILLE, KY., April 21.—The Kentucky Wagon Mfg. Co. has brought out a refined model of its Dixie Flyer, which is to sell for $1,365, with either touring or roadster body. Among the improvements are the use of a slightly larger engine with forced feed lubrication and a hot-spot manifold; fan driven from the generator shaft; larger universals; improved brake and clutch pedals; Bower roller bearings in all wheels; oil cups instead of grease cups. The external appearance of the car has been considerably improved through the use of a straight-line body with square type radiator.

The engine is a four-cylinder Spillman, driving through a Borg & Beck clutch to a Grant-Lees three-speed gearset, and floating axle. The engine is equipped with a Dyneto two-unit electric lighting and starting system, with a Bendix gear. The ignition system is Connecticut. The wheelbase is 112 in., and tires are 32 x 4. Equipment includes an eight-day clock, Motor-Meter, and the usual tools.

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Briscoe Up to 75 a Day

JACKSON, MICH., April 17—The Briscoe Motor Corp. turned out 50 cars daily during March. This figure has been increased to 75 this month. New contracts during the past few days have been received from Brooks Motor Co., Baltimore; the Kline Motor Co., Louisville, Ky., and the Briscoe-Syracuse Sales Co., Syracuse, N. Y.

—

Eccolene Increases Capital

DETROIT, April 19.—The Eccolene Mfg. Co., maker of Eccolene, has increased its capitalization from $10,000 to $500,000. Plans call for the sale of $300,000 of common stock and $200,000 of preferred 7 per cent accumulative stock. An advertising and sales campaign will be started soon.

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Combination Truck-Tractor on Market

CHICAGO, April 21—A new type of combined industrial truck and tractor is being marketed by the Clark Tructractor Co., Chicago. It is a three-wheel, gasoline-driven vehicle for industrial purposes in and around factories and other large organizations. It is equipped with a 4-cylinder, 3⅛ x 4½ engine, dry-disk clutch, three-speed selective gearset, internal-gear drive, and may be fitted with either cargo or dump body or platform. The machine weighs 2050 lb. and has a capacity of 1½ tons. The wheelbase is 72 in.; tread, 35½ in., and the overall length, 112 in. It will operate at from ¼ to 15 m.p.h. The selling price is $1135.

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Graham Trailer for $400

EVANSVILLE, IND., April 21—Graham Brothers have placed on the market a 2-ton four-wheel trailer to sell at $400. It is equipped with Hess axles, with the wheels mounted on Bock roller bearings. Springs are semi-elliptic and wheels carry 32 x 3½ pressed-on solid tires. The loading space is 118 x 59 in.; side racks are 22 in. high. The three side and end sections are removable.

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Schwartz Buys Emil Grossman Business

NEW YORK, April 18—L. M. Schwartz, formerly vice-president and sales manager of the Emil Grossman Mfg. Corp., has purchased the right, title and goodwill in that company and with it has acquired the trademark "Ever Good" identified with the Grossman lines of bumpers, mirrors, fan belts, wiring sets, etc., and also the trademark "Red Rib," designating lines of ignition cable and lamp cord. Schwartz's activities commence immediately under the former trade name (the Emil Grossman Mfg. Co.) and at the same address, Bush Terminal, Brooklyn, N. Y.

Latin America Offers Opportunities

January and February Automotive Exports Indicate Great Increase in 1919 Trade

NEW YORK, April 19—During the twelve months ending December 31, 1918, our exports of cars, trucks and parts to the Latin-American Republics had a total value of $18,976,637. The value of our exports during January and February, 1919, was $4,141,479. Throughout these periods we have had to face troubles and delays caused by severely limited shipping facilities and by restricted factory production.

If it be assumed that both these adverse conditions are factors which will have to be contended with during the remainder of the present year—an assumption which is absolutely against the weight of evidence—and that we are merely able to maintain the pace set by our January and February export figures, we still will be approximately 30 per cent ahead of our 1918 total at the end of the calendar year 1919.

Three months ago the Shipping Board allocated 455 vessels having a combined capacity of over 1,000,000 tons to Latin-American routes, but unfortunately had to withdraw them immediately in order to divert their tonnage to relieving the European food shortage.

When this need ceases to exist, it is anticipated that all these ships will operate in Latin-American service. Their capacity will be supplemented by that of a series of 12,000-ton freighters and yet a further series of converted transports of an individual capacity of from 8,000 to 15,000 tons, a service amply sufficient to link up our ports with those of Central and South America on a basis which will eliminate delay and insure prompt shipment.

There is no lack of orders for shipment of automotive products to Latin America, and given adequate shipping facilities there is no reason why the 30 per cent increase now indicated may not be expanded to 100 per cent or more.

Exports of Cars, Trucks and Parts to Latin-American Republics During the Calendar Year 1918

Country	Cars No.	Cars Value	Trucks No.	Trucks Value	Parts Value
Argentina	1,628	$1,673,137	45	$40,707	$2,100,114
Bolivia	15	29,187	16	41,116	7,303
Brazil	1,108	856,374	37	42,481	221,835
Chile	1,734	2,315,386	154	239,621	659,544
Colombia	126	95,677	4	7,385	26,864
Costa Rica	41	20,100	....	.....	2,772
Cuba	1,780	2,638,001	557	1,109,368	1,065,816
Ecuador	63	73,953	6	10,420	8,558
Guatemala	15	21,914	1	1,312	6,336
Haiti	92	59,098	10	9,664	21,650
Honduras	11	15,443	4	2,017	10,262
Mexico	1,915	1,539,263	397	524,035	506,747
Nicaragua	69	51,829	3	8,251	6,305
Panama	65	55,187	45	44,573	56,855
Paraguay	....	.....	....	.....	719
Peru	626	823,762	100	246,392	116,721
Salvador	62	77,184	3	10,561	9,970
Santo Domingo	220	169,285	19	16,497	59,120
Uruguay	1,351	799,787	15	13,512	137,991
Venezuela	118	104,942	7	7,100	57,134
Total	11,039	$11,419,509	1,423	$2,374,512	$5,182,616

Trade Resumed with Many Countries

WASHINGTON, April 21—A complete list of certain countries in Europe with which trade was prohibited during the war and with which business can now be resumed has been made public by the War Trade Board as follows:

Siberia,
Alsace-Lorraine,
Palestine,
Mesopotamia,
Serbia and Rumania,
Finland,
Szecho-Slovakia,
Bulgaria,
Turkey and Black Sea ports,
German Colonies,
The occupied territory of Germany,
Adriatic ports,
Albania and Montenegro,
Luxemburg,
Croatia,
Slavonia,
Bosnia,
Herzegovina,
Dalmatia,
Poland,
Esthonia,
German Austria.

Commercial Air Navigation in South Africa

WASHINGTON, April 19—South African authorities are making bids for airplanes released in England from war work, and plan to use them for commercial purposes in South Africa. Plans include the establishment of an air service, both passenger and mail, to more remote centers, and a fast mail service between Cape Town, Johannesburg, Durban and Port Elizabeth. Preparations have also begun for establishing an air route between London and Cape Town by way of Egypt. A demonstration flight will soon be made. Landing places and gasoline stations are being established between Cape Town and Broken Hill, in German East Africa and in Egypt, the landing places being 400 miles apart. The London-Cape Town route will be by way of Paris, Marseille, Rome, Crete, Alexandria and then over Africa. Handley-Page machines, capable of carrying a crew of 7 and 30 passengers, will be used. It is expected that the flight can be made in 6 days as compared with the present ocean mail service of 18 days.

Italy's Motor Service Links Up Railroads

PARIS, April 19.—Italy possesses 8700 miles of broad-track railroad and 8070 miles of automobile routes, over which a regular service is run to timetables. This big development of automobile passenger carrying and goods service is largely explained by the fact that Italy is a mountainous country in which railroads can only be built with difficulty. Most of the main railroad lines follow the coast, leaving the center of the country undeveloped. This defect has been remedied by the creation of automobile lines which link up with the railroads.

The development of public-service cars for goods and passengers began about 10 years ago on the initiative of the Fiat Co. At the present time, of the 400 officially recognized routes, 350, with a mileage of 6950, are fed exclusively by Fiat vehicles.

Exports of Cars, Trucks and Parts to Latin-American Republics, During January and February, 1919

Country	January, 1919 Cars No.	Cars Value	Trucks No.	Trucks Value	Parts Value	February, 1919 Cars No.	Cars Value	Trucks No.	Trucks Value	Parts Value
Argentina	232	$247,388	28	$60,800	$345,854	213	$324,193	11	$21,794	$38,287
Bolivia	...	.....	...	.....	5,592	...	.....	...	.....	536
Brazil	48	70,659	...	.....	46,019	121	148,673	5	9,765	87,869
Chile	73	139,064	1	3,282	42,372	64	153,619	3	7,672	57,331
Colombia	17	29,068	...	.....	9,757	3	2,301	...	.....	4,735
Costa Rica	...	.....	...	.....	4	...	.....	...	.....	.....
Cuba	91	197,856	82	154,016	181,342	213	290,807	34	92,429	141,141
Ecuador	2	2,925	2	3,900	1,339	2	2,734	...	.....	2,242
Guatemala	5	4,300	4	9,900	368	...	.....	...	.....	269
Haiti	22	18,558	...	.....	4,314	21	22,344	1	550	930
Honduras	...	.....	...	.....	249	...	.....	1	300	990
Mexico	163	217,934	73	113,019	50,853	203	149,536	47	42,416	45,324
Nicaragua	...	.....	1	4,000	1,507	4	3,616	...	.....	2,187
Panama	3	2,180	1	1,430	2,740	6	6,150	1	550	5,813
Paraguay	...	.....	...	.....	.....	...	.....	...	.....	.....
Peru	31	58,413	...	.....	16,261	77	147,961	4	10,540	24,845
Salvador	2	3,300	...	.....	1,061	7	9,346	...	.....	1,206
Santo Domingo	11	16,598	1	2,523	1,468	5	9,396	...	.....	1,627
Uruguay	44	108,673	1	2,600	45,969	25	38,106	1	1,070	17,621
Venezuela	20	34,396	...	.....	4,181	24	27,346	2	1,360	10,920
Total	764	$1,151,312	194	$355,470	$761,250	988	$1,241,128	137	$188,446	$443,873

U. S. Air Equipment Classified

13,057 Engines "Active," 10,858 "Obsolescent" and 2763 Held to Be "Obsolete"

ACTIVE

Planes	Engines
Curtiss JN-4-H	Hispano-Suiza, model I
Curtiss JN-4-HBO	Hispano-Suiza, model E-12
Curtiss JN-6-HO	Le Rhone, 80 hp.
Curtiss JN-4-G	.....
Curtiss JN-4-G	.....
Curtiss JN-7-H	.....
Curtiss JN-6-HB	.....
D.H.-4	.....
U.S. D-9-A	.....
S.E. 5	.....
V.E. 7-4-C	.....
Martin Bomber	.....
Hydros	.....
Le Pere	.....
Handley Page	.....
Sopwith-Dolphin	.....
Caproni	.....

OBSOLESCENT

Planes	Engines
Curtiss JN-4-A	Curtiss OX-2
Curtiss JN-4-B	Curtiss OOX-3
Curtiss JN-4-D	Curtiss OX-5
Canadian JN-4	Hispano-Suiza model A
Thomas Morse Scout with Gnome engine	.....

OBSOLETE

Planes	Engines
Curtiss R-4	Thomas Morse 8
Curtiss R-2	Curtiss model 0
Curtiss N-8	Curtiss OXX
Curtiss twin	Curtiss OXX-2
L.W.F.	Curtiss M-8
Standard J-1	Sturtevant 5-A
Standard L-2	Hall Scott A-5-A
Standard R-6	Hall Scott A-7-A
Martin R	Lawrence
Standard E	Clerget 9
Heinrich's C-1	Curtiss V-2
Aero Marine	Curtiss VX
Boeing	Wright 6 cyl.
Martin TT	Samson M-9
Martin R-6	Renault 12
Standard H-2	Renault 8
Standard H-3	Sturtevant 4 cyl.
Sturtevant F-4	Aero Daimler 6 cyl.
Bristol Fighter	Curtiss type S
Burgess Hydroplane	Le'aviateur 8

WASHINGTON, April 19—The Air Service has classified all airplanes and engines as either "active," "obsolescent" or "obsolete," and has placed 10,414 service engines, 2612 service planes, 2643 training engines and 2103 training planes, of which 80 per cent are new, in the active class. Obsolescent engines total 10,858, of which 42 per cent are new, and 2904 training planes, of which 17 per cent are new. Obsolete engines total 2763, of which 59 per cent are new and unused, and 2018 obsolete planes, of which 51 per cent are new.

A number of Curtiss and Standard models and Bristol Fighters, about which a great storm centered during the war, besides other planes, are classified as obsolete. The Bristol Fighter, it will be remembered, was found unserviceable, because, as pointed out in AUTOMOTIVE INDUSTRIES, the American officials selected it for the Liberty engine when that engine weighed 700 lb. in its experimental stage, but was too heavy—weighing 850 lb.—when it was finally installed.

Improved Curtiss planes, the Martin Bomber, the La Pere and several British planes are named as active, as are several Hispano-Suiza engines and the Lehrone.

By active planes are meant those which are maintained, repaired and re-ordered by the government for the Air Service. Obsolescent planes are those which are not regarded as worthy of re-order, but which will be used so long as repair parts are readily available, and they can be easily overhauled until in the judgment of the officer in charge they should be discarded. Obsolete planes and engines including those found dangerous or lack-in in speed or other qualities.

Herewith is the complete list, showing the active, obsolescent and obsolete planes and engines.

Herewith is the table showing number of planes and engines on hand of each of the three classes, those new and those used but in flying condition, together with those which are out of commission.

	New	Used, but in Flying Condition	Out of Comm.	Total	Per Cent New	Per Cent Useable	Per Cent Not Useable
ACTIVE							
Service engines	9,725	412	277	10,414	93	4	3
Service planes	9,264	198	150	2,612	86	8	6
Training engines	1,997	491	155	2,643	76	18	6
Training planes	740	1,019	344	2,103	35	48	17
OBSOLESCENT							
Training engines	4,541	4,417	1,900	10,858	42	41	17
Training planes	498	1,854	552	2,904	17	64	19
OBSOLETE							
Engines	1,638	116	1,009	2,763	59	4	37
Planes	1,037	68	913	2,018	51	4	45

Cancel Air Service Contracts

WASHINGTON, April 17—During the week ending April 5 more than $4,000,000 worth of Aircraft Production contracts were canceled, making a total of $500,679,617 of suspended and canceled contracts since the armistice. Following is a summary of the total cancellations up to and including April 5, 1919:

	Value
Engines and parts	$275,616,187
Airplanes and parts	166,081,004
Chemicals and chemical plants	18,334,715
Instruments and accessories	10,868,841
Balloons and supplies	9,314,963
Fabrics, lumber and metals	7,228,778
Miscellaneous	13,235,129
Total	$500,679,617

Vedrines Killed in Paris-Rome Trip

PARIS, April 21—(Special Correspondence)—Jules Vedrines, the French aviator, who was the first to make a landing on the roof of a building, was killed instantly today when his machine, on its way for a non-stop trip from Paris to Rome, dropped in the Department of Drôme at Les Fouillouses, about 225 miles from Paris. The machine, which weighed 5½ tons, was wrecked. It is thought that the accident was due to the plane collapsing in the air.

Postal Service Has 1,381 Vehicles

These Are in Use in 20 Cities—Bids Asked for Supplies and Parts

WASHINGTON, April 19—The United States Post Office is asking for bids on motor vehicle and aviation supplies to be filed not later than May 12. Supplies are required for 1433 cars and trucks, and include pneumatic non-skid casings, both fabric and cord, grey and red inner tubes of all sizes, inner patches, rims, solid, demountable and pressed-on tires, steel for demountable rims and hard base cushion tires of all sizes, fire extinguishers, hub odometers, spark plugs and porcelains of all sizes, graphite, grease, oils, automobile soap, radiators, 9000 gal. of Liberty aero oil and 175,000,000 gal. of aviation gasoline.

In order to provide information for bidders a list of the cities in which government owned motor vehicles are now being operated is given together with the number, type and size of the vehicles, as follows:

Atlanta
2 Ford, 750 lbs.
18 Commerce, 1-ton
Baltimore
15 Ford, 750 lbs.
14 Commerce, ¾-ton
4 G.M.C., 1½-tons
2 Packard, 3-tons
Boston
68 Ford, 750 lbs.
23 White, ¾-ton
14 Packard, 1½-tons
Brooklyn
71 Ford, 750 lbs.
20 White, ¾-ton
5 White, 1½-tons
5 White, 3-tons
Buffalo
25 Ford, 750 lbs.
2 G.M.C., ¾-ton
8 Lippard-Stewart, ¾-ton
1 U. S., 1½-tons
2 Brockway, 1½-tons
Chicago
166 Ford, 750 lbs.
10 Studebaker, ½-ton
35 White, ¾-ton
62 White, 1½-tons
2 Packard, 1½-tons
20 White, 3-tons
Cincinnati
23 U. S., 1½-tons
1 White, 3-tons
Columbus
10 Ford, 750 lbs.
6 White, ¾-ton
5 Packard, 1½-tons
Detroit
37 Ford, 750 lbs.
1 Overland, ½-ton
1 Reo
5 Buicks, ¾-ton
10 Packard, 1½-tons
Indianapolis
14 Ford, 750 lbs.
4 Studebaker, ½-ton
Jersey City
3 Ford, 750 lbs.
1 White, ¾-ton
Nashville
7 Ford, 750 lbs.
4 White, ¾-ton
3 White, 1½-tons
New York
98 White, ¾-ton
10 White, 1½-tons
42 White, 3-tons
75 Packard, 1½-tons
25 Ford, 750 lbs.
Norfolk
12 Dodge, ½-ton
9 White, ¾-ton
1 White, 1½-tons
Philadelphia
68 Ford, 750 lbs.
49 White, ¾-ton
12 G.M.C., ¾-ton
9 G.M.C., 1½-tons
8 White, 1½-tons
6 White, 3-tons
2 Kelly-Springfield, 3-tons
Pittsburgh
28 Ford, 750 lbs.
30 White, ¾-ton
2 White, 1-ton
8 Packard, 1½-tons
1 White, 1½-tons
Richmond
11 G.M.C., 1½-tons
St. Louis
47 Ford, 750 lbs.
14 G.M.C., ¾-ton
3 White, ¾-ton
1 White, 1½-tons
6 G.M.C., 1½-tons
Scranton
7 Ford, 750 lbs.
4 Commerce, ¾-ton
Washington
50 Ford, 750 lbs.
11 White, ¾-ton
1 White, 1½-tons
1 G.M.C., ¾-ton
1 G.M.C., 1½-tons

Bids will be opened at 10 a. m., May 12, and prices are to be quoted on the unit of each quantity called for under each item. Deliveries must be made within 30 days after orders are placed or otherwise specified by the Government.

Eisemann Reaching Normal Production

NEW YORK, April 21—The Eisemann Magneto Co. is rapidly reaching normal production. The plant is at present operating at full capacity, with part overtime. Orders on hand will keep the plant at full capacity for some time.

England Showing Interest in Commercial Aviation

LONDON, April 21—Some conception of the hold which commercial aviation is getting on the British nation is indicated in the expected transcontinental flight and also in the displays of London business houses. The Selfridge store has recently had a big attraction in a special Handley-Paige fuselage adapted from bomb-carrying for passenger flight. It has a saloon-body accommodating 17 passengers, as well as another person in a cock-pit in the nose of the craft, a pilot and assistant pilot. The complete machine, except for the passenger accommodation, is similar to the bomber, and is fitted with two Rolls-Royce engines, each of 350 h.p. fixed between the main planes, which will drive it at about 100 m.p.h. The extreme length of the fuselage is 62 ft. 6 in., and about one-third of this is occupied by the saloon, the height of which is 6 ft. 6 in. The span of the upper main plane is 100 ft., and the height from the ground to the top of the king-post is 23 ft. The weight of the machine, fully loaded, is about 6¼ tons.

At a luncheon which followed the opening ceremony, Mr. Handley-Paige stated that a number of these machines were now ready for use, and would be put into service, carrying passengers to the Continent as soon as the Air Convention, now under consideration at Paris, is signed. A new company, he said, had been formed for the purpose, and eventually he hopes to be able to convey passengers and goods to all parts of the world.

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First De Haviland on Exhibit

WASHINGTON, April 21—The first De Haviland 4, U. S., designed and built by the Dayton-Wright Airplane Co., has been placed on exhibition at the National Museum in this city. The plane has been used in more than 4000 flights, has been in the air 1078 hours, and traveled more than 111,000 miles. It carries full military equipment, including camera, oxygen bottles, machine guns, etc.

This is the type of airplane that was severely criticized during the war, but more than 1800 of which were delivered in France and used extensively.

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Engine Dynamometer to Be Established

WASHINGTON, April 18—The National Advisory Committee of Aeronautics will erect an airplane engine dynamometer at Langley Field for the purpose of testing airplane engines.

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Chicago-New York Flight in 7 Hours

NEW YORK, April 22—Capt. E. F. White, an army aviator, flew from the landing field of the Aero Club of Illinois, Ashburn Field, Chicago, to Hazelhurst Field, Mineola, L. I., in a non-stop flight lasting 6 hours and 50 minutes. Captain White left at 9:50, Central time, yesterday morning and landed here at 5:40, Eastern time, yesterday afternoon, making an average speed of 106.38 miles an hour, covering a distance of 727 miles. Express train time for the same distance is 18 hours.

The record flight was made in a De Haviland 4 biplane, equipped with a 12-cylinder Liberty engine, and was made for the most part at an altitude of 12,000 ft. In recognition of "the demonstration of the practicability of airplanes for fast transportation," the Aero Club of America will award a medal to the aviator, to be presented during the Aeronautic Convention at Atlantic City, on May 4.

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Suspend M. A. M. A. Rule for Atlantic City Airplane Show

NEW YORK, April 21.—The Motor and Accessory Manufacturers Association rule with regard to shows was suspended insofar as the airplane exhibition at Atlantic City is concerned, at the monthly directors' meeting, so that members of the M. A. M. A. may exhibit.

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Aero Gas for Airplanes Only

WASHINGTON, April 18—The use of high test aeronautical gasoline for any purpose other than airplane consumption has been prohibited by the Director of Air Service, who has issued an order prohibiting its use in passenger cars, trucks, motorcycles and for cleaning purposes in the army.

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Air Service Buys Free Balloons

WASHINGTON, April 19—The Air Service has ordered 36 free balloons to be made out of the surplus kite balloon fabric. These will be used for early training of fliers and especially to instruct them in meteorological phenomena.

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Landing Fields and Airdromes for Massachusetts

BOSTON, April 18—The Massachusetts legislature has been asked to provide suitable airdromes and landing places throughout the State in order that aviation may be developed in this territory. A bill designed to give the Highway Commission power to license aviators and also to pick out places on which to land has been introduced.

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Inter-City Reliability Run

CHICAGO, April 14—The long-promised inter-city reliability run in which dealers and owners from Chicago, New York and other cities were to compete, seems probable of accomplishment this year, with teams from New York and Chicago as contestants. According to the plans announced Friday by the Chicago end of the contest, there will be two teams from this city, one representing the Chicago Automobile Club, and the other the Chicago Athletic Association. The date probably will be June 13 and 14, and the route will be from New York City into Massachusetts, and return to New York.

Air Service Disapproves Competition for Money

WASHINGTON, April 21.—The Air Service has refused to allow any army fliers and airplanes to compete for the Pulitzer or other trophies at the Pan-American Aeronautical exhibition which will be held at Atlantic City in May. Reasons given are that the demobilization, reorganization, Victory Loan campaign and consequent reduced personnel prevent the Air Service from taking part in this exhibition. Announcement made by Major General C. T. Menoher, Director of Air Service, also states that as an additional reason the Air Service considers it an improper use of the time of fliers and government property to compete for purses and individual prizes.

"The Air Service," stated Major General Menoher's announcement, "will give favorable consideration to any project of this sort which has for its object aerial performances without remuneration for development, charitable or co-operative purposes of an international, national, State or civic character, but must adopt as a War Department policy disapproval of any project which involves competition of air service teams or individuals with private clubs or enterprises for money or other prizes or trophies."

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Pulitzer Trophy for Airplane Contest

NEW YORK, April 18—A Pulitzer trophy to be awarded annually for airplane competition has been offered by Ralph, Herbert and Joseph Pulitzer, Jr., according to a statement made by the Aero Club of America. The nature of the competition will be decided yearly by the Aero Club. This year it will be awarded for the longest non-stop flight from any point to Atlantic City or from Atlantic City to any other point during May, while the Aeronautic Convention is going on there. The prize will be held for a year by the winner, but must be won three times to become the permanent possession of the competitor.

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Government Not Exempt from Revenue Tax

NEW YORK, April 7—It is likely that the Internal Revenue Bill will hold that sales of passenger cars and trucks made to the Federal government, or to the various state governments, are not exempt from the new war revenue tax. Under neither the old nor the new law are there any provisions specifically exempting the government. Under the old law, however, government purchases have been held to be exempt. Under recent interpretations of the new law, such sales apparently are not exempt. It is pointed out, however, that when dealers are approached by a state regarding the purchase of a car the dealer may pass the order along to the factory and act as a commission man, instead of taking title to the car, and then reselling it. The National Automobile Chamber of Commerce points out that under such a plan no tax will apply.

Fordson Tractor Assembly

(*Continued from page* 900)

fact, each machine can readily handle 50 per day or more if it is required, which means that, on an 8-hr. basis, 15 min. is considered ample running-in time.

The block is then put back on the track by means of the overhead carriers and the castellated nuts on the ends of the bearing cap studs are wired and locked in position. With these bearings adjusted and in place, the main work of assembling the engine is practically over, as this is the most delicate part of the job.

The engine now is ready to have its accessories and housings placed upon it. The magneto assembly is a part of the flywheel and, therefore, is handled as a sub-assembly. It is a progressive bench operation, as will be seen from Fig. 10. An angle-iron carrier is utilized, and the assembly is carried on, step by step, down the bench, as illustrated. Fig. 10 shows the work in progress, looking at it from the end when the assembly is completed. The unfinished flywheels are in a conveyor rack behind the bench. There are eight men on this job, assembling Fordson magnetos, and they assemble one every 1½ min. The finished magnetos are conveyed to the traveling rack, where they meet the engine just as it has had its field plate bolted on, as will be seen in Fig. 11. These field plates are also a sub-assembly, having the field coils mounted in place. This sub-assembly is considered a manufacturing operation and is done in the shop department.

There is but little beyond routine work left to do to the engine after it leaves this point. The oil pan is bolted in place, the head put on, manifold fitted and the carbureter and intake are bolted in place, all of these parts having been prepared and placed at convenient points along the line. The timing gear housing also is placed on the engine before it leaves this chain, having been stored in racks alongside of the track at about the proper height so that but little lifting effort is required to get it over to the tracks.

Fig. 12 shows these timing-gear housings on their rack ready to be bolted on the engine, and further down the track some of them may be seen in place. At the right of Fig. 12 may be seen how the transmission track is keeping parallel with the engine track right through. When the engine is completed and reaches the end of the track it is picked up by an overhead carrier and brought over to the beginning of the tractor assembly department, where it meets the transmission completely assembled and ready to be united with the engine assembly to form the tractor.

(*To be continued*)

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Dividends Declared

Kelly-Springfield Tire Co., New York, has declared a cash dividend of $1 per share, and a stock dividend of 3 per cent on common, payable in common, on May 1 to stockholders of record April 15. Fractional shares will not be issued. Negotiable warrants which may be exchanged with other warrants aggregating in face value one share of the common stock will be issued representing fractional shares.

Packard Motor Car Co., Detroit, regular quarterly dividend of 2 per cent on common, payable April 30 to stockholders of record April 15.

Truscon Steel Co., Detroit, quarterly dividend, 4 per cent on common, payable April 15 to stockholders of record April 5.

The Willys-Overland Co., Toledo, regular quarterly dividend, 25 cents a share, payable May 1 to stockholders of record April 15.

Fisher Body Corp., Detroit, 1¾ per cent, quarterly, payable May 1 to stockholders of record April 22.

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Highways Transport Committees Reorganized

WASHINGTON, April 19—The Highways Transport Committee of the Council of National Defense has been reorganized so as to include direct representation from the Office of Public Roads, of the Department of Agriculture, the Bureau of Markets of the Department of Agriculture, the Post Office Department and the Department of Commerce. The committee as reorganized comprises:

John S. Craves, of the Council of National Defense, chairman.
James I. Blakslee, fourth assistant postmaster-general.
J. M. Goodell, consulting engineer, Office of Public Roads.
James H. Collins, investigator in Market Survey, Bureau of Markets.
R. S. MacElwee, second assistant chief, Bureau Foreign and Domestic Commerce.
Charles W. Reid, executive secretary, and
G. B. Clarkson.

The committee will be assisted by the Highways Transport Committee Advisory Board, comprising:

William Phelps Eno of Washington, D. C.
Prof. Arthur H. Blanchard of New York.
C. A. Musselman of Philadelphia.
Raymond Beck of Akron, Ohio.
John T. Stockton of Chicago.

Special co-operation and attention is going to be given to the short-haul problem as connected with the U. S. Railroad Administration, and rural motor express as related to interurban electric line and waterways traffic.

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Explosives for Road Building

WASHINGTON, April 21—All surplus TNT and other explosives owned by the War Department and which can be used for building highways and other similar works have been turned over to the Department of the Interior. A portion of the explosives will be used for clearing lands if the soldiers' settlement bill is passed by the next Congress to allow farm lands for honorably discharged soldiers.

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New Russel Internal Gear Axle

DETROIT, April 19—The Russel Motor Axle Co. will shortly commence delivery of a new internal gear drive axle for heavy duty trucks.

22 Indianapolis Racers So Far

NEW YORK, April 21—Although the entry lists are open until May 1, the Contest Board of the American Automobile Association has already received 22 official entries for the annual 500-mile Liberty Sweepstakes to be run off on the Indianapolis speedway May 31. The drivers and the special cars they will pilot are:

Driver	Car
Clifford Durant	Chevrolet special
Dorio Resta	Sunbeam
W. W. Brown	Richards special
Earl Cooper	Stutz
Eddie O'Donnell	Duesenberg
Kurt Hitke	Roamer-Duesenberg
Ralph DePalma	Packard special
Denny Hickey	Stickel special
Arthur Thurman	Thurman special
Ralph Mulford	Frontenac special
Jean Chassagne	Sunbeam
Jules Goux	Peugeot
Louis Chevrolet	——
Tommy Milton	Duesenberg
Eddie Hearne	Durant special
Louis LeCocq	Roamer special
H. C. Simmons	Hudson special
Elmer P. Shannon	Mesaba special
J. M. Reynolds	Hudson special
Wilbur D'Alene	Duesenberg special
Ray Howard	Peugeot special
Eddie Pullen	Hudson special

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Films to Further Safety and Highway Development

WASHINGTON, April 21—Motion pictures will be used extensively in the United States by the government through the Visual Instruction Section of the Department of the Interior to further highways construction, highways safety and other matters of national interest. The National Automobile Chamber of Commerce has been requested to secure films from the manufacturers and furnish them to the Department of the Interior for this work. Lists of films will be compiled in the near future.

Distribution of films, it is expected, will be made through various university extension divisions and other organizations such as boards of education in the various states and communities. Films will be distributed free by the government. Motion picture machines are to be purchased by the individual community.

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Electric Graphic Meter

(*Continued from page* 892)

deviation, which seems to be characteristic of the drilling operation. It may be that at this point the chip begins to clear itself; it may be that the change in power consumed is due to some characteristic of the drill spindle; or it may even be due to hardness in the iron plate at that point.

When the curve reaches point G the drill begins to pierce the bottom of the plate and the friction decreases, causing the curve to drop, until at E the drill breaks through and the curve rapidly falls off along the line F to the no-load level at G. The amount of current drawn at G indicates the frictional horsepower required to drive the machine idle.

It will be seen that it takes an average of a little less than 4 kilowatts to force the six spindles through the 1¼-in. plate.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. ..... .02 - .03
Phosphoric (85%) lb. ..... .35 - .39
Sulphuric (60%), lb. ..... .008

Aluminum:
Ingot, lb. ..... .29 - .31
Sheets (18 gage or more), lb ..... .42

Antimony, lb. ..... .07 - .07⅛

Burlap:
8 oz., yd..... .07⅛ - .07¼
10½ oz., yd..... .09⅛

Copper:
Elec., lb. ..... .15¼ - 15½
Lake, lb. ..... .15¾ - 15⅞

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.40
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.20
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. ..... .50

Graphite:
Ceylon, lb. ..... .09 - .22
Madagascar, lb. .. .10 - .15
Mexico, lb. ..... .03¾

Lead, lb. ..... .04¾ - .05

Leather:
Hides, lb. ..... .25 - .41

Nickel, lb. ..... .40

Oil:
Petroleum (crude):
Kansas, bbl. ...2.25
Pennsy., bbl. ...4.00
Gasoline:
Auto, gal. 24½
68 to 70 gal..... .30½
Lard:
Prime City, gal. 2.45 -2.50
Ex. No. 1, gal.... .95 -1.06
Linseed, gal. ....1.53 -1.56
Menhaden (dark), gal. ..... .95

Rubber:
Plantation:
First latex pale crepe, lb. .... .49
Brown crepe, thin, clear, lb. .... .46
Smoked, ribbed sheets, lb..... .48

Para:
Up River, fine, lb. 56
Up River, coarse, lb. ..... .34
Island, fine, lb.... .47½ - .48

Shellac (orange), lb. .60 - .64

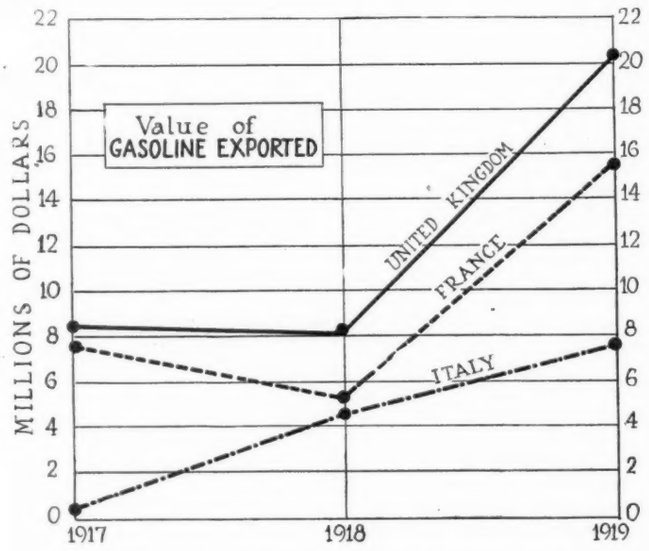
Spelter, lb. ..... .06½

Steel:
Angle beams and channels, lb... .03
Automobile sheet (see sp. table).
Cold rolled, lb....0625
Hot rolled, lb.....039

Tin ..... .72½

Tungsten, lb. 1.00

Waste (cotton), lb.. .12¾ - .17



This chart indicates the enormous increase in value of gasoline exported to the United Kingdom, France and Italy during the period immediately preceding the signing of the armistice

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock.....	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock.....	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.....	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping.....	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close April 19

	Bid	Asked	Net Ch'ge
Auto Body Company.....	9	10	..
Briscoe Motor Car com...	14	..	+1
Briscoe Motor Car pfd....	50	65	..
*Chandler Motor Car.....	144⅛	146⅛	+4⅛
Chevrolet Motor Car.....	199	201	..
Cole Motor Car Co.....	93	105	..
Continental Motors com..	7⅝	8	—⅛
Continental Motors pfd...	96	99	..
Edmunds & Jones com....	15	20	..
Edmunds & Jones pfd....	75	90	..
Electric Storage Bat.....	69	71	..
Federal Motor Truck.....	34	37	..
Fisher Body Co. com.....	62¾	64¾	+4¾
Fisher Body Co. pfd.....	92	94	..
Ford Motor of Canada.....	310	320	+25
*General Motors com.....	179¼	180¼	+3¼
*General Motors pfd.....	91⅜	93⅜	+¼
Hupp Motor Car com.....	8¼	8¾	..
Hupp Motor Car pfd.....	96	99	..
Kelsey Wheel Co. com....	35	37	..
Kelsey Wheel Co. pfd.....	93	95	..
Manhattan Electric S. com. ..	48	..	
Maxwell Motor com.....	38½	39½	—⅛
Maxwell Motor 1st pfd....	66½	67½	—¾
Maxwell Motor 2nd pfd...	30¼	31¼	..
McCord Mfg. com.....	34	37	+1
McCord Mfg. pfd.....	95	100	+4
Mitchell Motor Co.....	30	34	+3
Motor Products Corp.....	..	35	..
Nash Motors Co. com.....	230	250	..
Nash Motors Co. pfd.....	95	100	..
National Motor Co.....	16	20	+1
Packard Motor Car com...	135	145	+13
Packard Motor Car pfd...	99	101	..
Paige-Detroit Motor com..	29½	30½	+1
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck.....	23	25	+2
*Pierce-Arrow M. Car com.	50	51	+½
Pierce-Arrow M. Car pfd..	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company.	21	22	+3
Reo Motor Car Co.....	23¾	24½	..
Republic M. Truck com...	40½	42½	+1
Republic M. Truck pfd...	91	95	..
Saxon Motor Car com.....	7¼	9¼	+⅝
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp..	92⅞	94⅞	+1⅞
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com....	69½	70½	+3⅞
Studebaker Corp. pfd.....	94	97	..
*Stutz Motor Car Co.....	54⅝	55⅝	—1⅜
United Motors Corp.....	46½	48½	+⅞
White Motor Co.....	55⅞	56⅞	+¼
Willys-Overland com.....	29⅞	30⅞	+⅝
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.....	77½	79½	—1¼
Firestone T. & R. com....	140	145	—4
Firestone T. & R. pfd....	100	102	..
Fisk Rubber Co. com.....	135	140	—2
Fisk Rubber 1st pfd.....	100	105	..
Fisk Rubber 2nd pfd.....	137	142	..
Fisk Rubber 1st pfd. conv.	105	110	..
Goodrich, B. F., com.....	66½	67½	..
Goodrich, B. F., pfd.....	108	110	+1½
Goodyear T. & R. com....	280	287	+10
Goodyear T. & R. 1st pfd.	105½	107½	..
*Goodyear T. & R. 2nd pfd.	105	107	—2
*Kelly Springfield com....	121½	122½	—4½
Kelly Springfield 1 pfd...	95	97	..
Lee Tire & Rubber Co....	26½	27½	+½
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	170	175	..
Miller Rubber Co. pfd....	102	104	..
Rubber Products Co.....	125	130	..
Portage Rubber Co. com..	158	162	..
Swinehart T. & R. Co....	77	81	..
U. S. Rubber Co. com....	85¾	86¾	—¾
*U. S. Rubber Co. pfd....	109½	110½	—2⅜

*Ex dividend.

Bradley Is Back

NEW YORK, April 22—L. M. Bradley, former manager of the Motor and Accessory Manufacturers' Association, who was obliged to leave his position about Jan. 1 and go to Daytona, Fla., because of a breakdown following influenza, has returned to New York. He has regained his health and will make his future plans public soon.

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Pennybacker on Highways Work for A. A. A.

WASHINGTON, April 19—J. E. Pennybacker, director of roads, has resigned as chief of management of the United States Bureau of Public Roads to devote his energies to American Automobile Associations highway work.

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Rydehn Made Superintendent of Bantam Factory

BANTAM, CONN., April 19—Stuart S. Rydehn has been appointed superintendent of the factory of the Bantam Ball Bearing Co., succeeding Edward H. Cox, who resigned.

—

Fred W. Thomas, formerly chief engineer for the Olympian Motors Co., Pontiac, Mich., has opened a consulting and sales office at 335 Guardian Building, Cleveland.

—

W. R. Eaton, formerly district sales manager of the Moon Motor Car Co., St. Louis, has resigned to become president of the Aconite Tire & Rubber Co., St. Louis.

—

Frank R. Farnham has been elected vice-president of the Rex W. Wadman organization. He was formrely sales and advertising counsel of Hollister-White Co.

—

R. A. Loftus has been made factory representative of the Hession Tiller & Tractor Corp., Buffalo. He was previously assistant sales manager of the Cleveland Tractor Co. He will immediately proceed to organize the sales force in the Eastern section of the United States.

—

Matt R. Korshin, who for a number of years was Eastern district sales manager for the Atterbury Car Co., Buffalo, has become Western sales manager for the Selden Truck Sales Co., Rochester, with headquarters at 2334-2336 Michigan Avenue, Chicago. He succeeds A. R. Kroh, who left to become associated with the Goodyear Tire & Rubber Co., Akron. As Western sales manager, Mr. Korshin will be in charge of the dealer organization in Illinois, Indiana, Wisconsin, Minnesota, North and South Dakota.

—

H. P. Schuyler, for the past five years district sales manager of the American Ever Ready Works, has resigned to become manager of the accessories department of the Northern Electric Co. of Minneapolis and Duluth.

Men of the Industry

Changes in Personnel and Position

Duplex Engine Governor Adds to Force

BROOKLYN, April 21—J. K. Cravens has been appointed sales manager of the Duplex Engine Governor Co. He was formerly connected with the Excelsior Motor & Mfg. Co., Chicago, the F. A. Ames Co., Owensboro, Ky. and more recently with the Wright-Martin Aircraft Co., New Brunswick, N. J.

George L. Ritter, who has been with the company for several years, has been promoted to assistant sales manager. J. N. Ryan, recently discharged from the Air Service as a pilot, will cover New York, New Jersey and New England. R. Weston Doherty, who, it was recently announced, would cover this territory, will not be connected with the company.

—

Charles G. Jerosch has been appointed manager of the export office of the Corbitt Motor Truck Co., Henderson, N. C., which has recently been opened at 66 Leonard Street, New York City.

—

H. S. Lyons, who for two years prior to his entry into the Aviation service had charge of the sales of C-H electric devices in the territory covered by the Chicago office of the Cutler-Hammer Mfg. Co., Milwaukee, has received his discharge and returned to the employ of the company, doing sales work in the magnetic shift department.

—

C. N. Bradford, for two years in charge of cost and efficiency of Briscoe Motors Corp., Jackson, has been made head of the cost and efficiency departments of the Auto Body Co., Lansing.

—

Edwin Denby, president of the Denby Motor Truck Co., Detroit, late major of Marines, has resumed his duties as head of his company after 18 months service.

—

Arthur J. Peebles, former special representative of the Goodyear Tire & Rubber Co., has been made general sales manager of the Armstrong Rubber Co., Garfield, N. J. He was former secretary of the Ohio Automobile Trade Association, and an active worker in the affairs of the old National Automobile Trade Association. The Armstrong company has recently completed a new factory and anticipates a production of 800 tires and tubes a day during the coming year.

—

M. T. Langlais, associated with the L. Peacock Auto Co., distributors of Service trucks in San Francisco and Oakland, died last week.

Changes in Savage Arms Management

NEW YORK, April 18—A. E. Borie has resigned as president of the Savage Arms Corp. and has been elected chairman of the board of directors. This step was taken because his multiplicity of interests in this and other companies do not permit him to devote the necessary time to the duties of that position. W. L. Wright, formerly vice-president and general manager, succeeds him as president. F. R. Phillips has been elected vice-president. F. R. Pleasanton remains general works manager and Arthur F. Hebard has been appointed general sales manager. F. R. Schaefer remains sales manager of the products manufactured at the Sharon, Pa., plant, which include frames, axles, transmissions and other parts for cars, trucks and tractors. Brockholst Mathewson will represent the company in Detroit.

These rearrangements in organization are a clear indication of the company's complete change from war to commercial basis.

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W. E. Marvel of the Service Motor Truck Co., has been appointed district manager for the company in Utah, Colorado, Wyoming and parts of Mexico and Idaho.

—

W. C. Biddle, assistant sales manager of the Franklin Automobile Co., Syracuse, N. Y., has resigned to form the Branklin-Biddle Co., Toledo, dealers in Franklin cars. Mr. Biddle has been with the company since 1913. E. P. Johnson, a member of the sales force since 1915, will succeed him as assistant sales manager.

—

O. S. Tweedy, vice-president and general manager of the L. A. Young Industries, Inc., Detroit, has resigned, to take effect May 1. He was formerly with the United States Tire Co. He has not yet announced his future plans.

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U. S. Rubber Elects

NEW YORK, April 22—Samuel P. Colt was elected chairman of the United States Rubber Co. at its organization meeting. Officers are: President, Charles B. Seger; vice-presidents, James B. Ford, Homer E. Sawyer, Elisha S. Williams, J. Newton Gunn, Ernest Hopkinson and W. G. Parsons; treasurer, W. H. Blackwell; comptroller, W. G. Parsons; secretary, Samuel Norris; assistant secretary and treasurer, John D. Carberry; assistant comptrollers, H. B. Hubbard and W. O. Cutter. The executive committee is composed of Chairman Samuel Colt, Vice-Chairman Lester Leland, Charles B. Seger, James B. Ford, Walter S. Ballou, and Nicholas F. Brady; and the operating council of Charles B. Seger, chairman, the vice-presidents and Theodore Whittelsey.

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Auto Specialties Canadian Branch

ST. JOSEPH, April 19—The Auto Specialties Co. will build a branch factory in Windsor, Ont. It will be a duplicate of its plant here.

Republic New 8-in-1 Body

ALMA, MICH., April 19—The Republic Motor Truck Co., this city, has brought out a standard all-purpose farm body designed especially for Republic trucks for general use on the farm. There are eight complete types of bodies combined in one, all of these bodies being secured by adjustments which one man can make in a few seconds.

The body is made of kiln-dried hardwood lumber and can be used as a platform body with head board and end gate; as a platform body with extension side boards, head board and end gate; as a platform hay rack with the side boards sloping to support the hay; as a regulation wagon box with removable sides and end gate; as a combination grain, apple and potato box with two-sections, tight removable sides or as a three-section tight removable side box, or as a combination stock and basket rack box. The body can also be used as a straight cattle rack type suitable also for transporting cotton.

The body will sell for $200 in No. 2 size, 11½ ft. long, or $175 in No. 1 size, 9½ ft. long. The weight of the body is 650 lb. Larger sizes can be secured to order. The bodies are painted in the lead ready for shipping.

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B. & W. to Make Radiators

CHICAGO, April 18—The B. & W. Manufacturing Co., recently organized to build radiators, is capitalized for $600,000. Its officers are: President and treasurer, Lawson W. Wright, Evanston, Ill.; vice-president, Gage P. Wright, Mitchell, S. D.; secretary, Charles H. Blenkiron, Mitchell, S. D. The officers, with J. C. Blenkiron, Frank Wright and Paul M. Young, form the board of directors.

The active management of the business will be in charge of S. D. Briggs, who has been connected with the H. S. Franklin Mfg. Co., the Buick Motor Co., Pence Automobile Co. and the Hupp Motor Car Corp. C. E. Brelsford, formerly with the Splitdorf Electric Co., will represent the company in the East, with headquarters at Detroit. R. H. Cory will handle the Western territory, with headquarters at the Chicago office. Fenton L. Howard is the engineer and Philmore F. Spery factory superintendent. The factory and offices are at 5235-5257 Ravenswood Avenue.

Production is already under way and the company reports that contracts have been closed for 40,000 radiators. F. H. S. & Co., manufacturers' agents, with offices in the Grant Park Building here, will handle the sales to jobbers.

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New Plant for Copper Products

CLEVELAND, April 18—The United States Copper Products Corp. will soon be housed in a new manufacturing plant, which will be completed and in operation by May 1. The first unit is nearly finished and covers 200 x 350 ft.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Two New Jordan Bodies

CLEVELAND, April 21—The Jordan Motor Car Co. has made a number of refinements in its chassis and has brought out two new bodies, one a roadster to be styled "Playboy," and the other a touring model, to be styled "Jordan Silhouette." Both are straight-line types with slanting windshields and narrow, vertical hood louvres.

—

Bristol Builds Passenger Plane

WASHINGTON, April 22—The Bristol Airplane Co. of England has constructed a new passenger airplane, according to a commerce report from London. The plane has a seating capacity for 14 passengers in addition to the necessary mechanics and pilot. On its trial trip it carried 12 passengers, pilot and one mechanic, climbed 6200 ft. in 7 min. 15 sec., with an air speed of 125 m.p.h. The passenger salon is ventilated to avoid drafts.

The machine stands 20¼ ft. high and from tip to tip measures 81½ ft. It weighs 16,500 lb., the power being sufficient to lift this load to a height of at least 3 miles and at 10,000 ft. to give the airplane a speed of 113 m.p.h. The engine houses are built on the middle of the three pairs of wings. On each side there are two 410-hp. engines, the total power being 1640 hp. Flight can be maintained by any two of the four engines should the others break down.

—

Maibohm Will Move to Sandusky

RACINE, WIS., April 18—When its $175,000 plant is completed at Sandusky the Maibohm Motors Co. will move its entire organization to that city. The executive offices and a portion of the manufacturing end have already been moved, occupying temporary quarters in Plant No. 5. The new plant will comprise approximately 75,000 sq. ft., and is expected to be ready for occupancy in about 60 days. The site consists of 17 acres.

—

Saginaw to Handle G. M. Properties

SAGINAW, April 19—The Saginaw Products Co., a division of the General Motors Corp., has been organized as a holding company and will conduct the business of the Jackson-Church-Wilcox Co., the Saginaw Malleable Iron Co., and the Central Foundry Co. Articles of association have been filed showing a capitalization of $10,000 and listing as stockholders George H. Hannum, manager of local General Motors interests, Henry L. Barton and H. H. Rice, Detroit.

Details of Olds New Buildings

LANSING, April 21—The addition of five new buildings, with a combined floor space of 1,000,000 sq. ft., costing, with equipment, $4,500,000 and meaning an increase of more than 2,000 employees, is the 1919 expansion program of the Olds Motor Works. The project is a phase of the $37,000,000 expansion program of the General Motors Corp. recently announced by President W. C. Durant.

The five additional units do not include the new engine plant just completed and now in production. When this new plant reaches capacity output, it will require 800 more men. Two new axle plants will be built. Each of these will be 140 x 750. One will be built at once. The other will go up this summer.

Each unit will employ from 750 to 800 men. Both will be 1-story with a narrow second story running the entire length of the building on the east. This floor will be devoted to recreation rooms for employees, dining rooms and offices for axle department foremen and their clerical help. The axle plants will be built of brick, steel and glass. The plants will cost approximately $1,325,000 each.

Each will contain complete heat-treating departments and electrical sub-stations, equipped with transformers and switch boards controlling all machinery. The two plants will have a floor space of 267,000 sq. ft. All Oldsmobile axles will be made here as well as axles for all other General Motors passenger car units with the exception of Buick. The two units will be separated by a railroad track and each will have a loading dock 16 ft. wide.

The assembly plant will be lengthened by a 4-story addition, 91 x 600, which will give this building a total length of 1840 ft. Each floor of the extension will provide 54,600 sq. ft.

A sheet metal manufacture and enameling plant will be built. This will be 1-story, 180 x 480, with a 2-story wing, 90 x 360. It will be concrete and steel with a saw-tooth roof and cost $400,000, and its equipment $150,000. It will bring into use 155,000 sq. ft. of floor space. Under the present arrangement there is a large space left between the main assembly building and the warehouse. Before the concrete shipping docks were built last year, a track ran between the two buildings. Now that shipping has been taken care of elsewhere, the tracks have been removed and a new building to occupy this space is rapidly nearing completion. This establishment is to be 71 ft. wide by 700 ft. long and will accommodate the sewing and trimming departments. This building and new equipment which will be added to that already in use will cost $125,000.

Last year the company installed a new heating plant, which is equipped with two 500 hp. Erie City boilers with automatic stokers. This plant will now be doubled in size. This also involves additional water tanks for the sprinkler system.

In addition to the new units, the entire present Oldsmobile plant will be overhauled. A complete system of elevated electric trucks will be installed. They will be operated by storage batteries. A number of other units have been planned, but when they will be built will depend upon future business conditions.

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White Machine Works Doubling Facilities

EAU CLAIRE, WIS., April 21—The A. E. White Machine Works, manufacturing automotive parts, supplies and accessories, has completed plans for erecting a 2-story, 50 x 120-ft. plant. The company is employing 50 men in night and day shifts. When the new plant is finished the force will be increased to more than 100. The line of truck and tractor appliances will be enlarged to include several new designs.

Calendar

SHOWS

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

April 23 - 25 — Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

Aug. 18—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

RACES

April 24—San Bernardino, Cal. Rim of the World Hill Climb.

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15—Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

April 28-May 1—St. Louis, Mo. Chamber of Commerce of United States Convention.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May 21-24—Washington — Conference on Weights and Measures — Bureau of Standards.

May—Washington, Pan-American Commercial Conference, Pan-American Union Building.

June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.

June 23-28—Ottawa Beach, Mich. —S. A. E. Mid-summer Meeting.

Sept. 22-24—Philadelphia, Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

Buy Parts for Army Truck Maintenance

WASHINGON, April 18.—The War Department continues to place orders for large amounts of tires, gasoline, spare parts and repair parts for the maintenance of trucks and cars in the army, both abroad and in this country. Among the contracts recently placed were orders to the Packard Motor Car Co. for parts valued at $106,584; Fisk Rubber Co., $156,777; Goodyear Tire & Rubber Co., tires and tools, at $853,000; Nash Motors Co., spare parts, at $126,000. Following is a list of contracts placed recently:

Continental Rubber Co., Erie, Pa., 3500 pr. tires at $4.20, $14,700.

Fisk Rubber Co., New York, 4833 casings, with tax, $156,777.13.

Union Oil Co., Los Angeles, 70,000 gal. gasoline at 19 cents, 3500 gal. at 18½ cents, 90,000 gal. aviation gasoline at 22 cents, 8000 gal. Liberty Aero oil at $0.445, 100 gal. trans. lubricant at 24 cents; total, $37,331.50.

Goodyear Tire & Rubber Co., 4000 tubes, $6,987.93; casings, including tax, $846,113.90.

Firestone Tire & Rubber Co., Akron, 1000 casings at $9.86 plus packing, $9,871.10; 230 tires at $32.37, $7,445.10; 8600 tubes plus packing, $14,501.32.

The Mathers Spring Co., Toledo, 170 cart front springs and 170 part rear springs, $7,553.18.

Muncie Gear Works, Muncie, Ind., repair parts to maintain 2000 military trucks, $17,671.40.

Locomobile Co. of America, Bridgeport, Conn., spare parts to maintain 1195 Riker trucks, with tax, $60,463.03.

Packard Motor Car Co., Detroit, spare parts, including tax, $106,584.41.

Premier Motor Car Corp., Indianapolis, Ind., mounting 1021 steel ammunition bodies on Nash chassis, at $17.19, $17,550.99.

Kissel Motor Car Co., Hartford, Wis., mounting 406 steel ammunition bodies on F. W. D. chassis, at $17.19, $6,979.14.

Continental Motors Corp., Muskegon, Mich., various parts, $5,411.16.

Pierce Arrow Motor Car Co., Buffalo, spare parts to maintain 1454 trucks with tax, $39,060.42.

Nash Motor Car, Kenosha, Wis., spare parts to maintain 3827 trucks, with tax, $126,232.98.

Four Wheel Drive Auto Co., Clintonville, Wis., spare parts to rebuild 150 trucks, including tax, $60,737.58; spare parts to maintain 1939 trucks, including tax, $64,825.07.

Cadillac Motor Co., Detroit, spare parts, with tax, $78,767.93.

Michigan Malleable Iron Co., Detroit, 500 sets wheels with skid hooks for 3-ton trucks, $74,392.12.

Fairmont Tool & Forging Co., Cleveland, 8000 kits tool for trucks, $31,200.

Michigan Boosts License Fees

LANSING, April 19—Car truck and motorcycle licenses in the state of Michigan may be boosted by the state legislature 10 cents per 100 lb. on passenger cars and from 15 to 25 cents per 100 lb. on all trucks, in addition to an increased tax on truck horsepower of from 15 to 25 cents. The horsepower tax on passenger cars remains unchanged.

The license increase is embodied in a substitute measure for the Evans bill. In addition to the increase in the license cost of all cars and trucks, a straight tax of 50 cents per 100 lb. is provided for all trailers. It is estimated that the revenue from the increased tax will amount to approximately $800,000 per year. The bill, it is said, will meet with little opposition in the house and senate.

Post-War Finance

(*Continued from page* 894)

Washington, their property rights abroad will be defended, if need be, scrupulously and sternly.

Another very vital post-war problem is that presented by the precarious financial condition of the railroads. Its multiple ramifications affect every phase of our business life. And the situation grows more desperate every day. During 1918 the deficit piled up under Government operation, and which is to be met out of taxation, was in excess of $200,000,000; to which has been added more than $70,000,000 during the first two months of the present calendar year. Yet rates are 25 per cent higher and the service poorer than ever. It is true that in February the gross earnings of the railroads increased $61,000,000 over the corresponding month in 1918, a gain of 21 per cent; but operating expenses, which a year ago had run close to gross revenue, increased $62,600,000, or 24 per cent. And the net operating income of the railways for February was nearly $37,000,000 less than the compensation guaranteed by the Government. In January the deficiency was $55,000,000.

Under the sympathetic management of the Railroad Administration, which recently granted a further wage advance of $65,000,000, wage increases of $910,000,000 have been allowed. During the last three years wages have increased $1,260,000,000 and have more than absorbed all additional revenues obtained from higher rates charged for freights and passenger traffic. A revolving fund of $500,000,000, which was voted to meet capital requirements, has become a dissolving fund in the face of railroad necessities. To meet the losses in operation and capital requirements of the roads, a sum aggregating more than $1,000,000,000 for the period covering Government control has already been required in Government funds to be raised from tax resources.

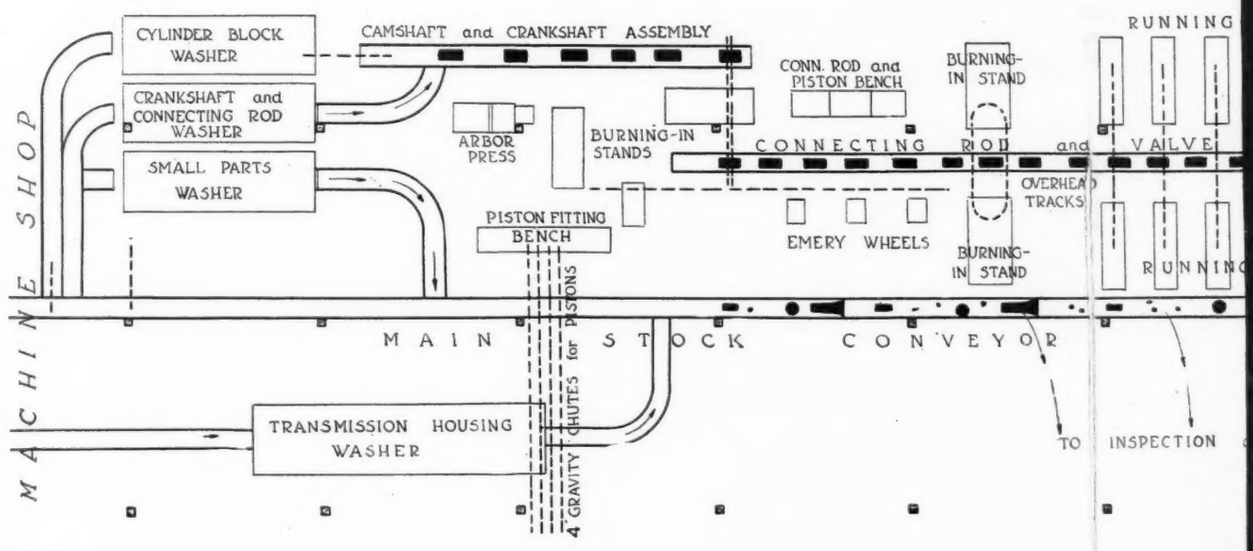
The country was promised, by those responsible for this debt, that vast economy in operation would be effected, which would show convincingly the wisdom of their plan. Experience has proven that the economies effected have been negligible in comparison with the expense added; and that, on the whole, less efficient service—less satisfactory to the public and less promising for future needs—has been rendered at a largely increased cost to the taxpayer.

Progressive Assembly Meth
Fordson Tractor Plan

THERE are two principal parts in the Fordson tractor, the engine and the large transmission housing which really takes the place of the frame. The assembly system, broadly speaking, consists of two parallel lines of conveyors, one carrying the engine block and the other the transmission housing until they are ready for bolting up on the final assembly conveyor. Beginning at the left of the plan herewith the machined parts first pass through electrically driven washing machines and then proceed to the assembly conveyors. The camshaft and crankshaft are fitted first to the engine block, after which it is run in a burning-in stand. From this point the conveyor chain is fed by overhead chutes with flywheel, fan pulley, magneto and the other parts forming the engine.

Meanwhile the transmission housing has been picked up from the main stock conveyor and hung open end up on the first of the housing assembly chains where the gears and clutch are dropped into place. The housing is then swung into a horizontal position on to the next step of the conveyor train, where the worm and rear axle are inserted, the axle housings bolted in place by electric bolt drivers. This part and the engine block are now ready for bolting up. They are transferred to the final ass drop them on to the startin for bolting up. From this p small parts such as coil bo conveyor.

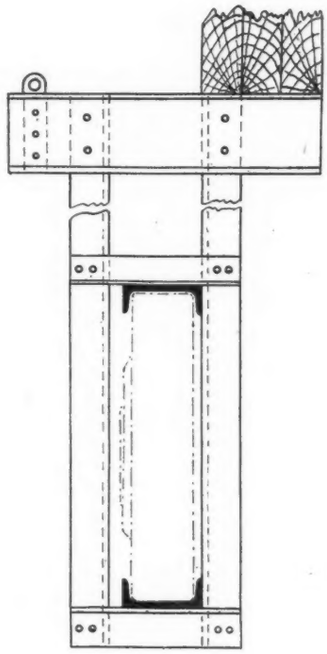
A most interesting meth consists of underground con side of the building. They tion they will assume on th of the pits alongside the a with no loss of time. The outside receiving departmen of an overhead gravity chu of gasoline at this time. A mounted on a swiveling arm engine. The tractor is then shop, where it is carried al paint. At the end of this con which starts the finished

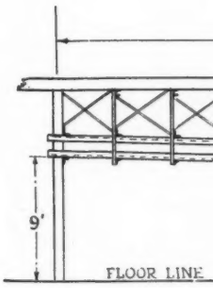


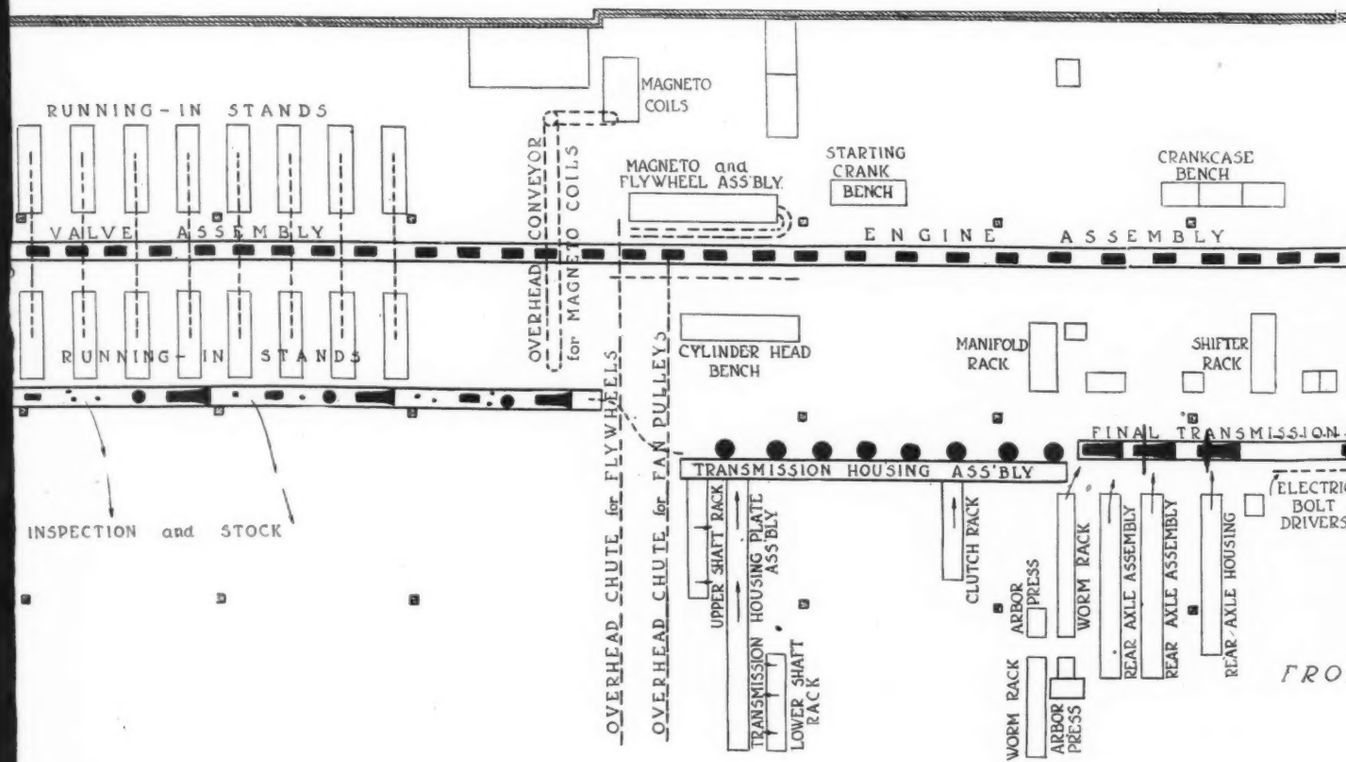
Methods in Plant

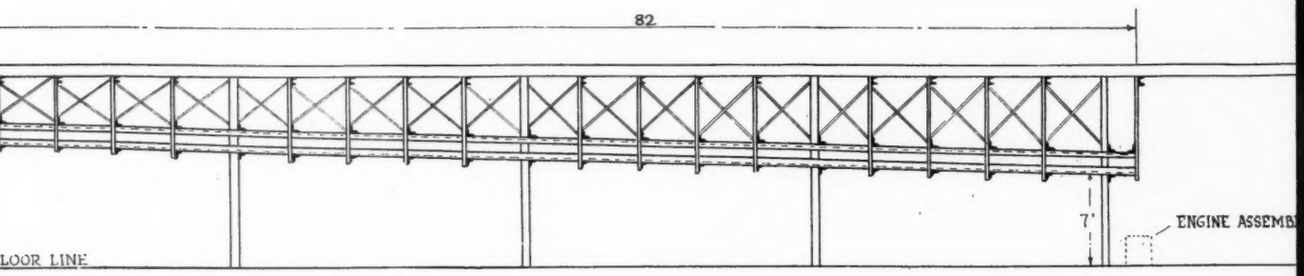
o the final assembly lines by overhead conveyors which to the starting points of these lines in correct positions . From this point to the end of the building the various uch as coil boxes, fan and air washers are fed to the

teresting method of feeding the wheels is used. This nderground conveyors from a receiving department out- uilding. They are carried on this conveyor in the posi- assume on the tractor so that they can be hauled out longside the assembly chain and mounted on the axle of time. The fuel tanks are also supplied from this ing department being passed through the wall by way d gravity chute. Each tank contains a small quantity this time. At the end of the chains an electric starter swiveling arm which grips the starting crank starts the tractor is then driven on its own power into the paint t is carried along the final conveyor and sprayed with end of this conveyor is another electric starting machine the finished tractor, now ready for the freight car.

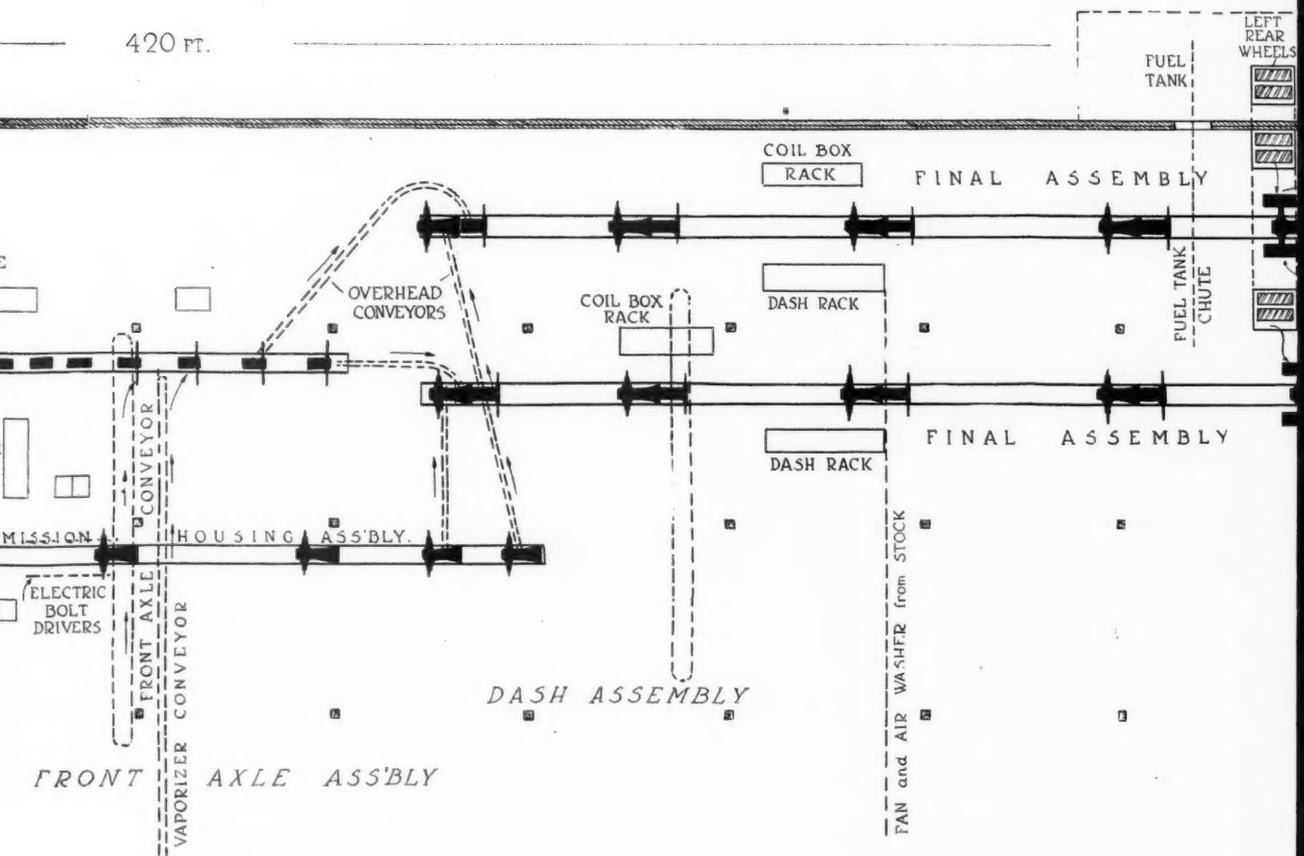


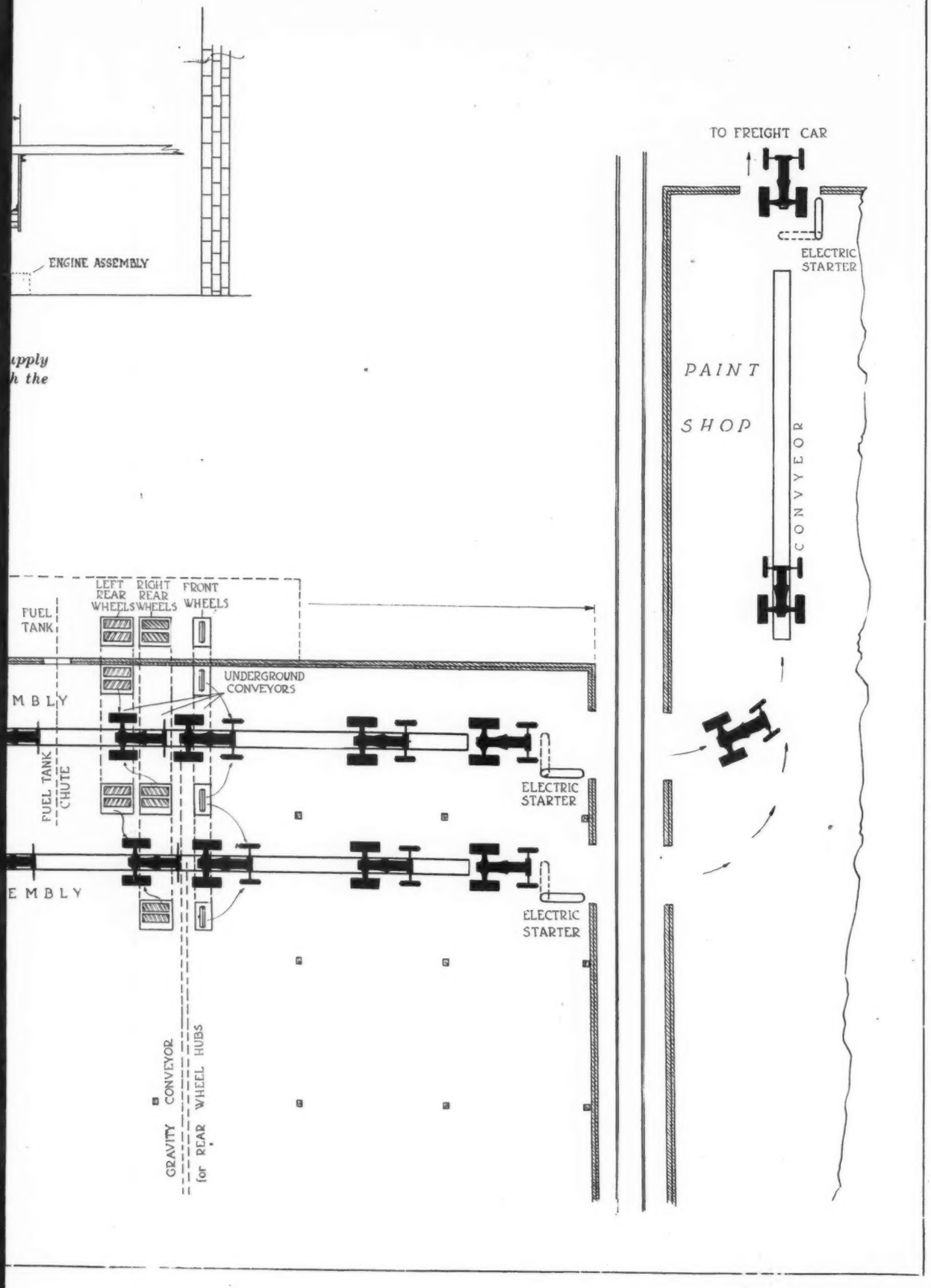






Elevation and section showing one of the several overhead gravity chutes which are used to supply the parts to the main assembly line. This particular one consists of two channel irons between which the flywheels are carried from the machine shop to a point over the assembly conveyor




ENGINE ASSEMBLY
TO FREIGHT CAR
ELECTRIC STARTER
PAINT SHOP
CONVYEOR
LEFT REAR WHEELS
RIGHT REAR WHEELS
FRONT WHEELS
FUEL TANK
UNDERGROUND CONVEYORS
M B L Y
FUEL TANK CHUTE
ELECTRIC STARTER
E M B L Y
ELECTRIC STARTER
GRAVITY CONVEYOR
for REAR WHEEL HUBS

upply
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